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INDUS-INFINITY FOUNDATION SERIES

CONTRIBUTIONS TO HISTORY OF
INDIAN SCIENCE AND TECHNOLOGY

ANIMAL HUSBANDRY AND ALLIED TECHNOLOGIES IN ANCIENT INDIA

(From Prehistorical to Early Historical Times)

P. P. Joglekar | Pankaj Goyal

Series Editor: O.C. Handa

Animal Husbandry and Allied Technologies in Ancient India

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P.P. Joglekar
Pankaj Goyal

Senior Editor
O.C. Handa

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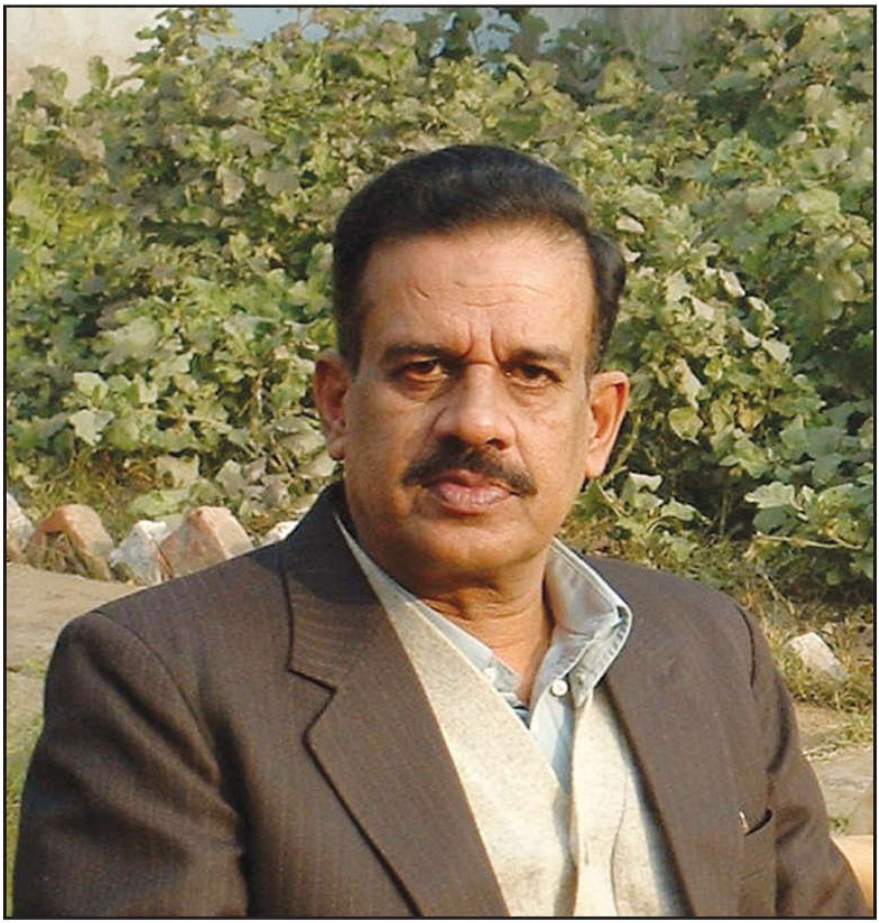

Dedicated to our beloved teacher Late Dr. P. K. Thomas (1947-2014),
who was like a lighthouse to us in our professional careers

Foreword to the Series

INDIA HAS HAD A LONG HISTORY OF CIVILISATION GOING BACK SEVERAL thousand years. In the global mind this civilisation is largely associated with spiritualism, philosophy and religiosity. There is also appreciation of great traditions that have continued: of performing arts in dance and music; of magnificent works in architecture, sculpture, painting; and of artisanal output of quality relating to the crafts. Over the last couple of centuries the image has been significantly one of poverty: surprising when John Milton in *Paradise Lost* had referred to 'the wealth of Ormuz and of Ind'. For many, it is a land of magicians and snake-charmers; of wild animals, like tigers and elephants; of mendicants, and mystics. This image is changing today with India moving powerfully into the knowledge economy and becoming a power to reckon with. What is not known and appreciated is the extent to which a whole knowledge system, and particularly scientific thought, has been inextricably linked to the development of this ancient and continuing civilisation.

There are many reasons for this. An important one is that there has been no major work on the history of science and technology in India. This is not to say that no work has been done in this field; there is a great deal available relating to specific areas, and involving specialised discussion, more so concerning technology. But there is nothing covering science and technology as a whole, dealing with the many diverse areas that it covered, and particularly its very different conceptual foundations, as also the extent to which it has underpinned the development of Indian society and civilisation. Because of this, in authoritative encyclopaedias, (such as Encyclopaedia Britannica), Indian science and technology is dealt with in a few hundred words. This must be contrasted with the situation in respect of China, following the great work of Dr. Joseph Needham, who produced thirty odd volumes on the history of science and technology of that country. This made a monumental impact in the academic repositioning of China as a scientific, rational and progressive civilisation. There is need for a similar effort with regard to Indian science and technology.

A further reason for the rather poor appreciation of the history of Indian science is that, in the public eye, the development of science and technology is manifested through its innumerable technological artefacts that affect daily lives in society, and great scientific

discoveries, both of which rapidly followed the developments that took place around a few hundred years ago in Europe with the birth of the modern, ongoing Scientific and Industrial Revolutions. As a result, the image of western science is so overwhelming that it swamps all earlier history.

In the West, there is major reference to the Greek origins of western philosophy and scientific thought. There was a strong coupling of Arab and Greek science, particularly as manifested in the historical Library of Alexandria. It must be remembered that India was an open country, and had significant interactions with the Arab world. Also, western scholars of the pre-Christian era had information on India through reports of Greek origin. It is, thus, that the 'Zero' and the 'Decimal place value system' became international and got referred to as the Arabic numerals; but those had their origins in India. Indeed 'Zero' had a deep philosophical meaning, that was characteristically Indian, denoting 'nothing or emptiness'.

There are many who, without a deep appreciation of the character of indigenously developed knowledge structures in India, often propagate the idea that science (which was so intimately interwoven with those knowledge structures) came to India from the outside through Islamic and Western conquests. The fact is that India absorbed all that came in from the outside (whether by invasion or otherwise) and gave freely of itself to the East and to the West; it was an open society.

The following reasoning may provide an indication why it has been difficult to compile a meaningful and reasonably comprehensive history of science and technology in India.

A great deal of knowledge transmittal in India has been through the oral tradition, having been conveyed through chants, hymns, poems and the like; this has been true even in mathematics. Those do not remain in the written record, and much of it has probably been lost with the cataclysmic changes in Indian society.

What has been written has invariably been on palm leaf and such other materials, followed by paper recordings; this is particularly the case for the earlier period in history prior to the advent of printing. A great deal of the source material on which writing has taken place, would have been subject to ravages of weather and insects, since India is located in the tropics characterised by high temperatures and humidity. After printed books came into existence, which ensured the availability of many copies of a text, India has not had a great history in science and technology, except in the last century.

Even when written, this was in the language then prevailing, namely, Sanskrit, particularly of the archaic variety and other related languages; there was also the problem of scripts. In recent years, one finds that those who know those scripts and languages, particularly their older forms, have little knowledge or interest in matters that are scientific. Their interests largely lie in areas of literature, philosophy, religion and the like. In contrast, those who know science, and could contribute to a meaningful analysis of recorded history, have scant knowledge of the language and the scripts of the past and often little interest.

Finally, what was transmitted, even on matters that were scientific, was mixed up with a great deal of philosophy, religion and mysticism; often practitioners of science of those days were philosophers or those high up in the socio-religious hierarchy. Knowledge in ancient India was much less compartmentalised; it was characterised by a holistic approach. To extract that which would be regarded as science, from this totality, is not an easy task. For all these reasons, the overall effort relating to writing of the history of science and technology in India has been a limited and scattered effort.

From what we know already, it is clear that there was a significant development of science and technology, covering a wide range of areas, with high creativity and originality, and over a long time-span. It is important to record and understand this. The purpose would not be to go back to the past from the viewpoint of claiming how great India was. Whilst there were many great discoveries made in India, which predate the same ones later made in the West, and now named after western scientists, the purpose would also not be to claim priorities or demand changes in attributions. What is important is to carry out proper historical work to understand the developments that had taken place and to record them appropriately.

There are two important reasons why this should be done. The first is from the viewpoint of understanding the nature of society in which science can flourish. Ultimately it is a thinking questioning society that can give rise to science. It is from this angle that Jawaharlal Nehru constantly spoke about the need for society to be imbued with scientific temper, namely, society functioning on a rational objective basis, which can give rise to the development of science – with innovation, originality, and creativity. These qualities cannot arise in a society which is hierarchical and authoritarian. On this aspect Gautama, the Buddha had remarked:

> ‘Believe nothing

merely because you have been told it
or because it is traditional
or because you yourself have imagined it
Do not believe what your teacher tells you,
Merely out of respect for the teacher
But whatever after due examination and analysis
You find to be conducive to the good, the benefit,
The welfare of all beings,
That doctrine believe and cling to,
And take it as your guide.'

It is important to understand why, with so much creativity and originality that had characterised Indian science and technology of the past, those developments did not last or takeoff on a self-sustaining basis.

The second reason why one needs to look at the history of science and technology in India is that, to a great extent, the conceptual approach in it has been different from which has characterised western development. It has tried to examine problems on a holistic basis. It has dealt with complexity. Thus the fundamental basis of the Indian system of medicine, referred to as Ayurveda, is very different from that which characterises the allopathic system. Ayurveda is a holistic system, which attempts to ensure harmony among the different components of the human body, and aspects of its functioning, including relationships with the outside world and inputs received. The approach is to ensure that the mind-body system remains in health, rather than in the treatment of disease. This involves a complex many body synergy (including the treatment with medication, body discipline of *yoga, meditation* and the like) rather than the deductive, reductionist 'active principles' approach of allopathy; the latter has certainly yielded a plethora of miraculous results.

One is also amazed at the dimensions with which the ancients grappled with, and their many speculations on issues such as origins of the universe and cosmology that are still with us. There is a great deal that one can learn from these excursions into ancient thoughts.

It is, therefore, important that any such history deals not only with narrow technological issues that related to societal needs but to science as a whole.

There have been a number of efforts to cover the history of science and technology in India. The Indian National Science Academy publishes a journal entitled *Indian Journal of History and Science*

under the guidance of the Indian National Commission for History of Science of the Academy. One of the other very ambitious ongoing projects in this area is that on the 'History of Science, Philosophy and Culture in Indian Civilisation' of which the General Editor is Prof. D.P. Chattopadhyaya. The series is projected to cover approximately seventy-five volumes, of which 12 have already been published. There are also many individual efforts such as the Sandeepani Science Gallery in Porbunder and innumerable publications that cover specific topics in science and technology such as 'copper and its alloys in ancient India'; works on 'Indian medicine and medicinal plants'; works on logic, where India was particularly strong, and so on.

I am glad that the Infinity Foundation has considered it appropriate to produce a series on the History of Indian Science and Technology (HIST). It is important that this effort covers not only areas of technology but also of science. It will have to bring together for this, scientists and historians of science, along with those concerned with philosophy, anthropology, religion, ancient Indian languages and many such other disciplines, who will have to interact strongly among themselves on the basis of available textual and other material. It has to be a holistic, interdisciplinary approach. This is a major task but well worth doing.

Prof. M.G.K. Menon, FRS
Advisor, ISRO (Department of Space), New Delhi

Note on Indus-Infinity Hist Project

INDUS UNIVERSITY IS AN ACCLAIMED INSTITUTION OF HIGHER education in Ahmedabad, Gujarat, engaged in offering UG, PG and Research programmes in diverse disciplines of Engineering, Technology, Applied Sciences, Management, Architecture and Aviation. The University is very focussed on seamlessly integrating Indian traditional values and global ethos through various activities as a component of its pursuit for academic excellence so that every 'Indusian' is a consummate Indian citizen upholding all that India or *Bharatvarsh* stands for.

For the past twenty years, Infinity Foundation based in Princeton, USA, has pioneered many areas of research concerning India's civilization. Among these has been the 20 volume serious on the History of Indian Science and Technology, of which this volume is a part. Its policy has been to work with world class scientists, archaeologists and historians to produce works at the highest standards.

India has a glorious past in various spheres of social and economic development. Indians have been the pioneers in Mathematics, Astronomy, Medicine, Neurosciences, Taxonomy, Yog, Architecture, Water Management and a number of similar areas. However, most of that has been either misrepresented or has remained shrouded under a well-thought strategy of those who were inimical to the India's glorious past. What is being ignored is the well-documented corpus of India's significant contributions in fields of Science and Technology.

The contents that our present-day students receive are projected mainly the scientific and technological advancements of the previous couple of centuries in the so-called developed "West". In fact, many of those are based on the scientific, technological and managerial advancements that the Indians had perfected in India during the pre-Vedic and Vedic periods.

The sad story is that the credit of all the knowledge and skills that our students acquire go to the scientists, technologists and management gurus of the western world. In that process, most of our youngsters have developed a sort of cynicism for all that is Indian, be it art, science, mathematics, philosophy or anything else.

Brand India or 'Indianness' has no value in the Indian student-psyche.

This dangerous cultural cynicism is further fuelled by what our students study as Indian history, most of which is the product of the colonial mind-set still prevailing.

History influences the future of a country. The honest narration of Indian history would provide the right reasons for all of us to be proud of our motherland, and India will be stronger in the process.The only way to re-establish the strong identity of Bharat is to develop undistorted and objective narration of the Indian History. Therefore,it is imperative that Indian narrative is accomplished bythe people wellgrounded in the Indian culture and its traditions.

In this direction, we are very much enthused and motivated by the selfless service of the globally acclaimed eminent Indian-American Shri Rajiv Malhotra, who has successfully reoriented the western gaze on Indian discourse in western academia through his untiring research-oriented publications and discourses for the past nearly two decades through his Infinity Foundation in Princeton, NJ, USA.

One of his most significant initiativeshas been the History of Indian Science and Technology (HIST) project. Started in 2002 as a joint convention of Infinity Foundation and Columbia University, the project has since then not only organised a number of HIST conferences, but also produced nine volumes under the HIST serieson diverse topics of the Indian traditional knowledge system (ITKS).

We in India have not done anything worthwhile. We have neither cared to study and research seriously nor have we cared to create proper documentation and honest narration of our glorious past. It is high time that we start addressing this grave challenge and face it head-on.We at the Indus are very seriously concerned about it as well, and to that end, we have established a dedicated Department of Special Studies to focus on the activities committed to seamlessly integrating Indian value systemswith the global ethos of the modern knowledge economy and rekindle in our students the real pride of India and ‘Brand India’.

As a part of that, we approached Shri Rajiv Malhotra and expressed our eagerness to support his cause. He readily agreed to partner with us and guide us to further the cause of HIST project. Thus was born the joint Indus-Infinity HIST initiatives through an MOU signed in October 2014.As a part of that MOU, we are committed to disseminate HIST knowledge throughout the globe through annual conferences and regular publications authored by the eminent specialists and scholars focussed on proper documentation and honest narration of the history of Indian scientific and technological traditions and knowledge

systems.

We at the Indus and Infinity feel very proud and privileged to jointly publish this 10th volume of HIST series on the very important topic *Animal Husbandry and Allied Technologies in Ancient India* authored by P. P. Joglekar and Pankaj Goyal and edited by O. C. Handa.

We hope that the readers across the globe, especially the Indian diaspora, would not only feel enriched by the HIST knowledge, but also would appreciate and encourage our joint effort in this monumental task.

We thank Shri Rajiv Malhotra and Shri O. C.Handa (the Senior Editor) for accepting our support and participation to partner in this important national cause. We also thankfully appreciate the stupendous work of the author/s and the publisher.

Dr. Nagesh Bhandari,
Chairman (Internal),
Indus-Infinity Foundation,
Indus Campus, Village Rancharda,
Via Thaltej, Ahmedabad-382115,
Gujarat, India

Editor's Note

ANIMALS HAVE BEEN THE BEST RESOURCE FOR THE HUMANS SINCE the remotest times. Humans have used them in innumerable ways to their benefit. They have been preying upon them for recreation, glorification, food and clothing, using them as the beast of burden, taming them to plough their fields and guard their homes, domesticating them for milk, training them for amusement and entertainment, and what not. While the humans have been the worst exploiters of animals, the animals have been their best friend. The history of the human and animal relationship has been a sordid affair through ages the world over.

In our times, when the natural habitats of animals are alarmingly shrinking to provide living space for the teeming human population, the green and forested areas – the natural habitats for animals — are rapidly depleting. Under the euphoria of 'development', environment has been the worst casualty. Deprived of their natural habitat, the wild animals have been the worst sufferers, which, in turn, has reflected upon the extinction of several faunal (and floral as well) species. The pernicious consequences of that degradation are now glaringly evident for everybody. Therefore, there is a dire need to look at this imminent crisis empathetically and to reorient holistically our understanding of the human-animal relationship for an altruistic and humane society.

In India, animals have been regarded with due respect and care. Many of them have been divinised, and many more accorded revered status as the *vahan* of most of the deities. There are numerous festivals throughout the country dedicated to the animals. Therefore, it is with good reason that we must look for the valid and sustainable solutions ensconced in our 'traditional knowledge systems'. For, there lies the secret for revival and survival of our faunal wealth and environment and for the eradication of most of the maladies generated by the so-called 'modern' and 'advanced' developmental programmes. The traditional Indian knowledge system (ITKS) provides a wealth of wisdom, for it is the repository of philosophical, social, religious, cultural, technological and behavioural human responses to the complexities of life and nature. The Indian traditional folk wisdom, interlaced with its quintessential culture and universal vision, upholds the dictum *jiyo aur jeene do*, that is, 'live and let live'.

Our two archaeologist friends, P. P. Joglekar and Pankaj Goyal, who specialise in archaeozoology, took up this challenge. They have attempted to look at this problem from the archaeology point of view. However, departing from the ossified methodology, they have adopted an interdisciplinary and holistic approach, of course, with an emphasis on the history of human-animal relationship in the Indian subcontinent from the primitive age down to our times. Digging out evidences, analysing and interpreting those to piece together the broken strands, they have built an interesting account of the animalhuman relationship. How have they faired in that effort is now for the conscientious readers to evaluate. As an editor of HIST series, I must confess that the effort and time that they have put in is well justified.

This is the tenth volume of the HIST series. With this, the HIST programme is entering into a new era. The Infinity Foundation has recently entered into an agreement with the Indus University (Ahmedabad). Under that agreement, the Infinity Foundation and the Indus University shall be undertaking the HIST volumes and all other HIST activities collaboratively.

Until date, nine HIST volumes have been published under the auspices of the Infinity Foundation. These are as follows:

1. *Harappan Architecture & Civil Engineering* by J. P. Joshi (2008)
2. *Marvels of Indian Iron through Ages by* R. Balasubramaniam (2008)
3. *History of Iron Technology in India (from beginning to Pre-Modern Times)* by Vibha Tripathi (2008)
4. *The Harappan Technology & its Legacy* by D. P. Agrawal (2009)
5. *Himalayan Traditional Architecture* by O. C. Handa (2009)
6. *Indian Zinc Technology in a Global Perspective by* J. S. Kharakwal (2011)
7. *History of Metals in Eastern India & Bangladesh* by Pranab K. Chattopadhyay & Gautam Sengupta (2011)
8. *Traditional Water Management Practices of Uttarakhand* by Manikant Shah (2012)
9. *Water Management and Hydraulic Engineering in India (c. 600 BCE-CE 1200)* by S. P. Shukla (2014)

This, the tenth HIST volume that deals with the *Animal Husbandry and Allied Technologies in Ancient India (from prehistorical to early historical times)*. This volume is of a special significance for us, for it is the first volume of the Infinity-Indus collaborative mission. I hope, like its other previous volumes, the scholars and general readers shall find this HIST volumes also very interesting and informative.

In the HIST, our effort has always been to generate a corpus of the Indian Traditional Knowledge System (ITKS) for creating a dignified awareness among the people about our own achievements. With that objective, we also inspire scholars and researchers for taking up studies that may accord credibility to the ITKS and establish its relevance in the modern technological and scientific scenario. It is a matter of great satisfaction for us that the already published HIST volumes have been successful to create such an impact among the academia and the general readers at home and abroad. I hope that this volume shall also receive the same response.

O. C. Handa
Senior Editor, HIST Series

Preface

WE THE HUMAN BEINGS HAVE CLOSE ASSOCIATION WITH THE animals around us since the very early times, almost from the period we became human. Archaeozoology, a sub-discipline of archaeology, provides one of the ways of looking at the human-animal interactions through a study of the actual remains of animals found in archaeological contexts. There is a growing body of archaeozoological data from South Asian protohistory (or late prehistory), which calls for a new synthesis on the origins of animal husbandry and other allied technologies in the Indian subcontinent. Recent advances in molecular genetics have also thrown valuable light on the domestication process of different animal. This genetic data also calls for a synthesis and the authors have tried their best to combine this emerging molecular data with archaeological information. The synthesis presented in this book outlines basic geographical patterns in the emergence of animal husbandry.

The purpose of this book is to make general educated readers aware of, how we humans interacted with animals, and which technologies were used to rear our domestic animals. Therefore, this book neither provides an in-depth history of archaeozoological research in the Indian subcontinent nor gives fundamentals of archaeozoological methods. Here we have made an effort to integrate archaeo-faunal data from a number of archaeological sites recovered from this part of the world. Hence, we have refrained from tracing the evolution of animal husbandry and other allied technologies on a comprehensive worldwide basis. We intend to indicate probable developments of animal husbandry in India. Our intention is also to give the reader an impression and understanding of the changing human relation with animals and the long-term and farreaching consequences thereof for human society. However, at the outset it is important to draw reader's attention to one very important point namely the paucity of information. Constrained by the handicap, we had to be content with whatever information we could gather from various sources.

We have structured this book with respect to different phases and themes. Most of the chapters in this book represent an interdisciplinary theme with major emphasis on the history of human-animal interactions in the Indian subcontinent. The chapters may, of course, be read individually, but taken together they form an interwoven set of

histories from different anthropological and archaeological traditions.

The first chapter introduces the book to the readers by discussing the complex ways that past and present humans have interacted with other animals. The chapter also describes the general span of human prehistory and history proper so that even those readers with no background in archaeology/anthropology could understand the concepts of culture and phases of social-economic foundations in terms of periods.

Following the introduction, the second chapter presents an examination of various dynamics of animal domestication. Different scholars have interpreted domestic animals in different ways and there is a long unsettled contradiction. Here the readers are introduced to the concept of fully domestic animals, and of tame animals. The chapter also discusses role of different causative factors that led to animal domestication. The readers will be acquainted with the most accepted view about biological position or position of domestic animals in animal systematics. Further, in this chapter we have discussed about unforeseen consequences of animal domestication with special reference to the relationship between animals, diseases and human society.

Third chapter gives an idea regarding when and where animals were domesticated, how did they spread to different parts of the world and the processes that led to domestication of animals from their wild progenitors. The information derived from both archaeological and genetic sources is included.

Forth chapter is focussed on archeo-faunal data recovered from the palaeolithic and mesolithic sites in Indian subcontinent. From subsistence point of view, during the Palaeolithic and Mesolithic periods humans were engaged in hunting-gathering way of life and were yet to settle in one place. However, as we shall see in this chapter, those people in different regions interacted in many different ways with plants and animals, and that in some cases those interactions were as enduring and complex such as agriculture and taming of animals. An interesting discovery in recent years has been the findings of ostrich eggshell from the late Pleistocene levels in India, archaeologically equivalent to the upper palaeolithic culture. The chapter summarises such discoveries and discusses the significance of those findings.

The phase of early farming is very important in human’s march towards sedentary lifestyle, development of agriculture and further

creation of wealth and related powerstructures such as the State. Fifth chapter is devoted to the early farming cultures of South Asia. It has been divided into three sections. The first parts incorporates description of the faunal remains recovered from various neolithic traditions such as the Mehrgarh neolithic, the northern neolithic, neolithic cultures of Ganga Valley and the Vindhyas, the eastern neolithic and the southern neolithic. The second section deals with the fauna identified from regional chalcolithic traditions such as the Ahar, Kayatha, Malwa, Savalda, Jorwe, Anarta, the pre-Prabhas, and people using Ochre Coloured Pottery (OCP). The last section of this chapter summarises the data and, more importantly, discusses the trends emerging form this data. This chapter, in a way, tries to situate the history of domestic animals in the Indian subcontinent on chronological and spatial basis.

The Harappan civilisation represents a glorious chapter in India's past. Chapter 6 is devoted completely to understand the role different animals played in this civilisation. The chapter also addresses the position of specialised groups like hunter-gatherers, cattle pastoralists, sheep-goat pastoralists and fishing communities in the complex economic web of the Indus civilisation. Readers will find a thorough discussion on the technologies that Indus people developed to make best use of the animal available to them. The chapter also has a brief discussion on the nature of the animal-based subsistence activities during the later phases of Indus occupation.

Seventh chapter deals with post-Indus cultures of South Asia. The faunal remains recovered from different sites belonging to Painted Grey Ware (PGW), Northern Black Polished Ware (NBPW), and Iron Age-megalithic cultures are dealt in detail. In addition, the faunal data identified from the early historical assemblages has been taken into the consideration.

Last chapter attempts to bring together and recapitulate the main themes discussed in this book and contains a short discussion on what the future holds for the humananimal relationships.

The book has been designed keeping in view the rationale behind the series of books on the history of science and technology in India under the 'History of Indian Contributions to Science and Technology' (HIST) project. There is no book or monograph available at present that deals with animals in ancient Indian context. The book, for the first time, has aimed to achieve: (a) exploration of data related to ancient animal usages in India, (b) look for developments in animal domestication and animal husbandry in India without putting an undue emphasis on

glorification, and (c) unravel the story of human and animal interactions in the past. This has been done so that the common educated masses may understand it easily. While addressing a relatively broad spectrum of readers, it also seeks to deal with technical topics, from genetics to archaeology, in sufficient depth to satisfy most academic specialists. Since the focus of the book is for general readers, at times we have limited our discussion to generalities. However, for those interested readers in more details, we have included important references for further reading. We do hope that this book would be able to bring out to the forefront Indian contributions to science and technology in the past through our analytical and objectively designed historical enquiry, particularly based on empirical data.

P.P. Joglekar
Pankaj Goyal
Department of Archaeology
Deccan College (Deemed University), Pune 411006

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We could think of writing such a book because we both got our training and opportunity to work on animal remains from archaeological sites at the Archaeozoology Laboratory of the Deccan College, Pune. We owe due thanks to all authorities of the Deccan College post-graduate and Research Institute for the support and work facilities. We are grateful to our teacher and builder of this laboratory Late Dr. P. K. Thomas for teaching us alphabets of archaeozoology and motivating us with his commitment to archaeozoology. He trained us in how to work with caution while studying faunal remains from archaeological sites and professionalism to timely deliver the reports of the faunal studies.

In this book, we have depended heavily on primary empirical data, gathered from our own works and of our colleagues and fellow archaeozoologists. Primary data in archaeology comes very hard way – weeks and months of painstaking explorations and excavations, often in harsh climate. We take this opportunity to thank all our archaeologist friends because of whom we could get access to remains of animals from several dozens of archaeological sites all over India.

Several colleagues and friends accepted our request and permitted us to use photographs taken by them. We thank them all: Professors K.K. Bhan, J. M. Kenoyer, J. N. Pal, V. S. Shinde, V. H. Sonawane, and Late Prof. G. L. Possehl; Drs. R. S. Bisht, J. S. Kharakwal, Arati Deshpande-Mukherjee, Amerandra Nath, Toshabanta Padhan and Akinori Uesugi. We also wish to thank Gopal Joge, Ashwini Shitole and Shantanu Vaidya, museum of the Deccan College, Pune and editors of *Man and Environment*.

P. P. Joglekar
Pankaj Goyal

1.

Introduction

IN THE LONG HISTORY OF HUMAN RELATIONSHIPS WITH OTHER Animal species, a turning point occurred when humans domesticated some of them. Domestication of animals led to the development of animal husbandry and various allied technologies. The present book is an attempt to present evidence of domestication in the Indian subcontinent. Over the past fifty years, there has been great progress in our understanding of human history, and the way we look at the animal world. This book provides a unique window through which to gaze into varied and fascinating human-animal interactions.

This first section of this chapter covers basic terms used in this book and describes the general span of human prehistory and history proper. The idea is to lend a hand to those readers who have no background in archaeology or anthropology. Thus, general readers may understand the concepts of culture and phases of social-economic foundations in terms of the periods that archaeologists employ for description in their professional writings. In the second section of the present chapter, the complex ways in which humans in the past and present have interacted with other animals are briefly discussed. While some of those interactions were predominantly economic and ecological, others were symbolic, philosophical and even, theological.

Geological and Archaeological Chronologies

Geological Timescale

It is generally thought that humans have always been the centre of universe, but science has proved that this is not so. The earth is about 4.5 billion years old but the humans appeared rather late—only some 200,000 years ago. Therefore, they have played a minor role. While earlier, it was not easy to accept that reptiles and insects had appeared on the earth long before human beings did, but many advances in the physical and biological sciences in the 20th century have greatly amplified our understanding of earth's history. Today, geologists use a chronology based on periods, such as the Jurassic (208-144 million years ago) and the Cretaceous (144-65 million years ago) to understand earth's history. Those periods have been named after the localities where corresponding deposits were first established and described, or else from the composition of deposits. Thus, the Jurassic period derives its name from the Jura Mountain in Switzerland and the Cretaceous is distinguished by the abundant deposits of white writing chalk. The most recent periods are the Palaeogene (65-23 million years ago) and the Neogene (23-0 million years ago). The Neogene includes the geological time up to the present day and it covers what is generally known as the later Tertiary and the Quaternary periods. The Neogene is divided into four epochs: Miocene (23.03-5.332 million years ago), Pliocene (5.332-1.806 million years ago), Pleistocene (1.8 million to 11,500 years ago) and Holocene (11,500 years ago to present). (**Fig. 1.1**)

The vast majority of events described in this book occurred during the Pleistocene and Holocene epochs. The Pleistocene and Holocene epochs together constitute the Quaternary period. The Pleistocene Epoch can be further divided into early or lower, middle and late or upper Pleistocene. During the Pleistocene Epoch, the genus *Homo* radiated into several species and adapted culturally and physically to several new habitats. That epoch was also characterised by dramatic climatic fluctuations, especially during a series of Ice Ages (late Pleistocene) from 126,000 until 11,500 years ago, hence the term 'Ice Age' become synonymous with the Pleistocene Epoch. It was the period when large ice-age mammals or megafauna—the mastodon, an elephant-like mammal, and the sabre-toothed cats—appeared and became extinct.

The Holocene Epoch, in which we are living, is regarded as the latest interglacial interval of the Pleistocene Epoch. The beginning of the Holocene Epoch coincides with the Neolithic period, which the archaeologists generally use to define the beginning of agricultural societies.

Era	Period	Start of Each Period (in millions of yea's)	Flora & Fauna
Cenzoic	Quarternary	1	Modern species of mammals, extinction of largo forms, such as mammoth: dominance of human
	Tertiary	54	Rise of birds and placental mammals
Mesozoic	Cretaceous	65	Dominance of flowering plants: extinction of largo reptiles and ammonites by end of period
	Jurassic	145	Reptiles dominant on land, sea and in air first birds; archaic mammals
			First dinosaurs, turtles, ichthyosaurs.
Paleozoic	Permian	245	Radiation of reptiles, which displaco amphibians as dominant group; widespread glaciation
	Carboniferous	286	Ferns as dominant plant group; sharks and crinoids abundant; radiation of amphibians; first reptiles
	Devonian	360	Ago of fishes (mostly freshwater); first trees and first amphibians
	Silurian	408	Invasion of the land by plants and arthropods; braciopods; primitive jawless vertebrates
	Ordovivian	438	Appcaranco of vertebrates (armoured fishes); brachiopods and cephalopods dominant
	Cambrian	505	Appeamce of all invertebrate phyla and many classes; dominance of trilobites and brachiopods.

Fig. 1.1 Geological time scale (Source: http://teachers.greenville.k12.sc.us/sites)

Archaeological Timescale

The history of human colonisation can be divided into two broad periods: the prehistoric (before the emergence of writing) and the historical (after the advent of writing). Based on technology, the archaeologists divide the prehistoric development of humans into three chronological stages: the Stone Age, the Bronze Age and the Iron Age. The Stone Age is again divided into three stages, namely, (1) Palaeolithic or the old Stone Age, (2) Mesolithic or the middle Stone Age, and (3) Neolithic or the new Stone Age. As the names suggest, the technology in those periods was primarily based on stone. Economically, the Palaeolithic and Mesolithic periods represented a

nomadic, hunting and gathering ways of life, while the Neolithic period represented a settled, food-producing way of life. Subsequently, copper was introduced as a new material and that period was designated the Chalcolithic period or the Copper Age.

The Palaeolithic or the Old Stone Age is further sub-divided into three stages: (1) the lower Palaeolithic, (2) the middle Palaeolithic, and (3) the upper Palaeolithic stages. Those Palaeolithic cultures belong to the Pleistocene Epoch. The antiquity of the lower Palaeolithic in the Indian subcontinent is uncertain. However, generally speaking, it goes back to the lower Pleistocene, that is, between 2.0 and 0.7 million years. The upper limit of the lower Palaeolithic is equally uncertain. However, at many sites, the lower Palaeolithic grades into the middle Palaeolithic. Since the absolute dates of the middle Palaeolithic sites range from ca.150,000 to ca. 20,000 years 'before present' (BP), it is quite likely that the lower Palaeolithic tradition persisted at least in some areas well into the upper Pleistocene. A number of radiocarbon dates from the upper Palaeolithic sites, available from Madhya Pradesh, Rajasthan and Maharashtra, suggest the duration of the upper Palaeolithic from 30,000 to 10,000 years ago (**Fig. 1.2**)

Fig. 1.2 Artists depiction of hunter's camp

The lower Palaeolithic is generally considered to have started with the emergence of first member of genus *Homo*. The middle Palaeolithic was characterised by extensive use of chipped stone tools by the

humans around the world, including the *Homo erectus*, *Homo ergaster* (meaning ‘working man’ or African *Homo erectus*), *Homo neanderthalis* and the *Homo sapiens* (the modern humans). The upper Palaeolithic, the final phase of Palaeolithic, is characterised by the smaller, more intricate and diverse range of tools. That was also the period when humans started creating increasingly elaborate art forms. The upper Palaeolithic tradition was succeeded by the mesolithic culture. The Mesolithic period belongs to the Holocene Epoch, which is well dated by a large number of ^{14}C dates from many sites in western and central India. Those dates range from *ca*. 10,000 to 2,000 years ago. The use of the term ‘mesolithic’ is relatively recent and was originally coined to cover the hiatus between the Palaeolithic and the Neolithic. It is generally used to refer to the human cultures of the postglacial times that used tools known as the microliths.

The mesolithic culture is generally followed either by the neolithic or chalcolithic cultures in the Indian subcontinent. Those cultures represent the earliest farming communities that show regional variations throughout the subcontinent. While the Neolithic is characterised by the presence of polished stone tools (tools made by grinding and polishing rather than by chipping), the Chalcolithic is characterised by the use of copper. The Bronze Age and the Iron Age are the successive stages, characterised by the metallurgy based predominantly on those metals.

An important thing to note is that this short discussion is provided here to acquaint readers with the general terminology of different cultural periods. Those periods have been discussed in detail in the relevant chapters. The dates given here are approximate and sometimes those largely overlap. Some cultures developed or acquired new technologies many centuries or even millennia before their contemporaries in different parts of the subcontinent did.

A Brief Look at Human-Animal Interactions

Humans started interfering in the breeding of animals relatively recently as far as the human prehistory is concerned. The animals occupied a special place in the human life and thought and they formed an integral element of the environments in which humans evolved. It can even be asserted that the interaction between the humans and animals, before the advent of agriculture, was a part of the evolutionary process of the humans themselves. Re-examining the human evolutionary process may help us understanding the roles of animals in human life. Therefore, we may start by looking at how the modern human arose as a distinct species and how their interactions with animals modified gradually. For that, we have to depend on the fossil record, as only it provides the direct evidence of human evolution.

Human Beginning

The emergence of modern human came at the end of a long and slow process of change that occurred gradually over a period of 40-50 million years, during which numbers of species emerged, evolved and became extinct. Over the course of the last five million years, human has gradually evolved out of an ape-like ancestor. In brief, human evolution is the story of an arboreal ape, which became a ground dwelling predator, and eventually gave rise to the modern human being. Along the way, short hairy body, medium-sized brain, crude stone tools and simple skills gave way to the taller, relatively hairless and fat body, large brain and many languages and cultures.

The fossil records and the distribution of our closest living relatives (the chimpanzee and the gorilla) place the cradle of humanity in Africa. However, how did humans start their amazing evolutionary journey? There is a gap in the fossil record and we can only hazard guesses. It is generally agreed that the humans and chimpanzees shared a common ancestor, who lived in Africa some six to eight million years ago. While palaeontology has not yet provided any evidence of that ancestor in the form of fossil, scholars have identified characteristics of that elusive species based on the knowledge of living primates (apes in particular) and humans. According to Coolidge and Wynn:

> It almost certainly possessed characteristics shared by all apes and humans: use of vocal communication, life with complex polyadic

> social interactions, expressive faces and reliance on facial recognition, use of tactical deception and hierarchically organised object manipulation. Because all African apes other than humans are forest dwellers who sleep in constructed nets, our common ancestors probably did too.
>
> *Coolidge and Wynn 2009: 86-87.*

The Australopithecines, who emerged about four million years ago, are considered the earliest members of the hominid clade. However, the recent studies show that those were not the earliest hominids and their purported ancestry to the early 'Homo' is even questioned by some scholars. Nevertheless, the Australopithecines provide the concrete evidence about the nature of earliest hominids. Since, the fossil evidences of that genus have been found comparatively in large numbers in several locations in Africa, the palaeoanthropologists have a good idea of their basic anatomy and the range of variability. That, combined with the detailed knowledge of local habitat, has allowed reconstructions of the way of life of those early hominids. Those hominids were fully bipedal, but they retained many ape-like features in their locomotor anatomy. The Australopithecines are generally categorised in terms of the 'gracile' and the 'robust' ones. Largely, the more gracile Australopithecines are considered earlier than the robust ones, which are generally assumed a later evolutionary trend or outcome.

Based on the larger jaws and molar teeth of the robust species, it was estimated that those ate an exclusively vegetarian diet, whereas the gracile species seem to have included some meat in their diet. Nonetheless, work on the strontium-to-calcium ratio in the bones of Australopithecines indicates that the robust ones, too, ate some meat (Sillen and Lee-Thorp 1993: 174). Thus, food formed the basis for the earliest interaction between the humans and other animal species. However, it seems that the Australopithecines probably subsisted more on vegetal foods, for which they foraged daily. Apart from opportunistically scavenging the remains of creatures that had been killed either by other animals or had died a natural death, they probably obtained little animal protein.

The early *Homo* probably evolved from one of the Australopithecines categories. *Homo habilis*, which first appeared in Africa approximately two million years ago, is believed to be the first species in the *Homo* line. While some argue that Australopithecines could have been the tool users, the first purposeful use of stone tools is linked with the appearance of the *Homo habilis*. Generically, that tool technology is known as 'Oldowan' after the site of Olduvai Gorge in Tanzania, where

Louis Leakey discovered the first Oldowan tools in the 1930s. However, some archaeologists prefer to use the term 'Mode One' tools to define those. In some ways, *Homo habilis* was similar to Australopithecines, but exhibited larger brains and dental or facial reduction. Analysis of the faunal remains and artefacts associated with that species indicates that those hominids had become predators, and caught and killed animals using the tools they developed. **(Fig. 1.3)**

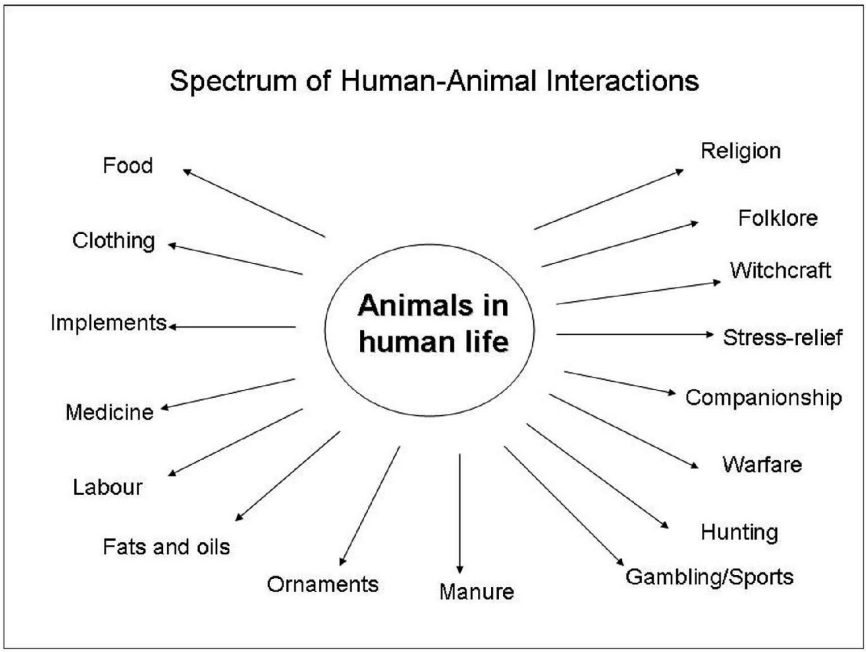

Fig. 1.3 Spectrum of human-animal interaction

The reduction in tooth size also supports the evidence of an increase in carnivory (flesh eating). However, while some scholars argue that hunting and confrontational scavenging occurred at such a stage of human evolution, when groups of people drove away the carnivore's still-fleshy carcasses, others argue for more passive scavenging, that is, eating from what carnivores had largely consumed. Nevertheless, the presence of stone tool cuts or percussion marks on a number of animal bones show that the carnivory was Oldowan-based, i.e., based on the tool technology. The early humans might have targeted such animals that he could easily hunt and kill, and those might have been the old, diseased, crippled or very young animals, or the ones as large as baboons and antelopes. The tools not only helped those hominids to kill animals, but also to slice through hide and gain better access to meat. Thus broadening the diet paradigm, the hominids could beef up his physique energy source, which also was essential for the

development of brain.

While those earlier hominids were hunting other animals, they were also subjected to predation. Fossils from South Africa have provided evidence of the extensive predation by leopards on the early hominids. That 'predator and prey' relationship between hominids and other animals portrays the pattern of struggle for existence —to eat and avoid being eaten—in which both the humans and animals had been engaged throughout the course of evolution. Thus, that 'predator and prey' connection became locked in an evolutionary race of the mutual adaptation in a way that the foraging and anti-predator strategies ran hand in hand on an evolutionary timescale. On one hand, vulnerable, naked and defenceless humans had to realise that they were potential meals for other animals, but on the other, they had to understand their prey animals in order to outwit them. The knowledge gained in those early times might have passed on as a body of folklore.

The next known hominid in the fossil record is the *Homo ergaster.* The current reconstruction of evolutionary tree of hominid suggests that *Homo ergaster* gave way to the *Homo erectus*. The *Homo erectus* seems to have remained restricted to the African tropics for the first several hundred thousands of years, but eventually by about 500,000 years ago, he began to shift gradually into Asia and other parts of Europe. *Homo erectus* was the first in the hominid series to stand upright. That was also the first species in which sexual dimorphism was reduced to that found among modern humans. With the appearance of that species, one finds a more complex stone tool technology, known as the 'Acheulian'. The accumulation of bones and stones that appear in the archaeological record suggests that human diet during those times included a greater proportion of meat than what the earlier hominid species ate. Some of the Acheulian sites have revealed the remains of large animal species, such as elephants and buffaloes, which indicates that Acheulian people were the formidable big-game hunters. Obviously, that would have offered the greatest return in term of food for the effort made. Some scholars even believe that the inclusion of a greater proportion of meat in the diet was a factor contributing to the expansion of population out of Africa (Foley 2001: 305331). The *Homo erectus* indicates a number of evolutionary shifts that could have been due to a greater carnivorous foraging. Those shifts were responsible for the increased body size, enhanced terrestrial locomotive ability, larger brain size, and the reduced gut size,

The *Homo erectus* is also associated with the controlled use of fire, which was one of the most important technological innovations in the

human evolutionary process. The controlled use of fire decisively separated our hominid ancestors from other animal species. Charles Darwin considered 'the art of making fire' as probably the greatest discovery (excepting language) that man ever made. While the earliest use of fire is still the subject of considerable debate, a number of archaeologists hold that *Homo erectus* was actively using fire some 400,000 years ago, but how efficiently could they use it is yet unknown. Those hominids and their successors not only gradually developed the skill necessary to keep fire alive, but also learnt how to use it beneficially. Protection from animals, especially the predators, by lighting fire after dark was one of the greatest advantages that instilled confidence in them and enabled them to gain a degree of dominance over other species, with whom they had been competing for food. The fire also enabled the humans to survive in cold climates, which led them to explore new territories. In addition, they also learnt the method of cooking food on fire. That difference between humans and other animals has long been appreciated and some scholars even used it to define humans, for example, Boswell (1773: 10 defined humans the 'cooking animal'. The advent of cooking, in a way, extended the variety and availability of animal foods, as meat could not only have been cooked, but also preserved by smoking and drying. Cooking also shortened the time that had to spend in eating (reducing mastication), resulting into the reduction in size of teeth, jaws and facial musculature, for they needed less effort for habitual chewing of tough foods. Furthermore, whole herds of ungulates could be driven to death by setting fire to the large forest areas (Clutton-Brock 1987: 188). Thus, the mastery over fire opened up an entirely new way of life for the humans. With the use of fire, they could improve their chances of survival and hunting skill. Thus, its domestication not only gave an additional advantage to humans over other animals, but it also changed the direction of human-animal interface significantly.

Hominids, generally 'Archaic *Homo sapiens*', lived all over the world between 800,000 and 125,000 years ago. Those hominids form a transitional group between the *Homo erectus* and modern humans, and include the Neanderthals. Those archaic humans were still anatomically distinct from the modern human beings. Though their teeth were markedly smaller than that of their predecessors, yet those were somewhat larger than what the modern humans have. Despite physical similarities to modern humans, those hominids lacked the cultural capacities. Archaic fossils are associated with the Acheulian or 'Mode Two', as some contemporary archaeologists prefer to designate it. That was the period, when the 'Levallois' tool technology complex, named after the 19th century finds of flint tools in Levallois-Perret in the

suburb of Paris, appeared. The Levallois tool technology was the name given to a distinctive type of stone knapping that the precursors to modern humans developed during the Palaeolithic period.

Neanderthals appear to have hunted at close range, using spears, axes, cutting blades, rocks and wooden clubs. Probably they inserted spears into the prey directly rather than throwing them from a distance. That gave evidence of the dangerous hunting techniques adopted by those hominids. At that point, evidences for big game hunting are also abundant. Later, stone tool technology evolved further and led to the invention of long-range implements, such as bows and arrows, which were essential not only to kill the prey (fast-footed deer and antelopes) in open grasslands, but also to counterattack the larger predators from a distance. That trend would have started by either throwing stones or the long and pointed wood spears at fleet-footed animals.

About 40,000 years ago, Neanderthals apparently bumped into an obstacle, for which they were not well prepared. The earliest modern people—*Homo sapiens*— encroached upon their resource utilisation zones and territories. Within 10,000 years of that first encounter, the Neanderthals were extinct, apparently unable to compete for resources with a growing population of anatomically modern humans, whose language, community culture, mobility and more effective weapons placed them in a far superior position than their opponents. *Homo sapiens* developed blade tool technology: a more efficient and economical means for making stone tools. Those people lived in caves, rock shelters, and open spaces, where they constructed shelters. They were a mobile people, probably moving seasonally to follow the availability of plants and animals throughout the year. Evidence of art in the form of sculpted figures, ornamentations, inscribed tools and cave paintings demonstrate that art played a role in their life as the means for the acting out symbolic behaviour and as a form of expression.

From the above account, it is clear that animals played a key role in human evolution. The inclusion of meat as a regular part of hominid diet not only determined the behavioural patterns of the early hominids, but also directed the course of human evolution. Now, let us look in a bit detailed manner as to how the increased carnivory directed the course of human evolution.

The main reason for development of sharp stone tools was for butchering animals, in particular to cut through the tough skin. For searching game animals or dead carcasses, the early humans needed to move over long distances. Flesh in the diet provided necessary

energy for such long distance movements. Also, the brain size increased (encephalization) due to high meat diet. Hunting is a group activity that requires cooperation and integration of movements. Several studies have shown that hunting was a factor responsible for social interactions leading to development of language skills.

Domestication of Plants and Animals

Important changes in human-animal relationships emerged with the development of agriculture and rearing of domestic animals, which replaced the hunting-and-gathering way of life. The gradual shift from hunting to herding animals began among some human groups around 10,000 years ago that transformed forever the age-old relationship between human (predator) and animal (prey). Therefore, domestication of animals is also seen as a development, which clearly separated human beings from the other animals. However, some scholars project domestication of animals as an extension, rather than a complete break, of the hunter-prey relationship. The transition from hunting-and-gathering to the true farming societies and pastoralism took thousands of years in most regions of the world, and not all the wild plants and animals that were eventually domesticated in a given area were domesticated simultaneously.

The process of plant and animal domestication one of the most significant developments in the culture and economy of ancient civilizations, but was the one that shaped human societies and their environments to this day. By domesticating plants and animals, 'the pioneering but humble revolutionaries who began to sow their seeds on fertile ground, and to tame their former prey instead of elaborating on over-specialized hunting techniques, set mankind on the spiralling trajectory of the last 10 thousand years' (Ingold 1988: 83). Therefore, it is not surprising that a large volume of literature is focused on understanding the evolution and cultural control of domestic plants and animals and its anthropological and evolutionary consequences. However, hunting of animals did not end with the advent of agriculture; there are still people who subsist by hunting-and-gathering activities. Nevertheless, only a tiny fragment of humans subsist entirely or primarily by these means. The important thing to note is that the behavioural patterns of hunter-gatherers are still present in humans today.

The development of agriculture and pastoralism brought about profound changes in human society. The first was human perception of the animals. The process of animal domestication changed man's attitude towards animals. Humans now began to see animals as the

renewable and surplus-creating resource. Instead of focusing just on the meat, the humans started to focus on the most important products of the living animal—its offspring. As soon as animals were herded or domesticated, humans became protectors rather than predators. As domestic animals required careful maintenance, people were compelled to develop practical knowledge, expertise and discipline necessary to ensure a continual and healthy supply of food-producing animals. Consequently, caring for the animals from their birth to death became an important preoccupation within human society (Swabe 1999: 8). The relationship became, so to say, mutualistic, in which humans and animals benefited from each other until death. Obviously, the domestic animals now counted as an object of social relationship in term of production from them and distribution from the very moment of their birth. Thus, the domestic animals became a very important resource of supporting and sustaining social relationship in a way that the human society could no longer be defined as a purely hunting society.

Initially, the livestock breeding and crop cultivation might not have provided to the humans a plentiful and nutritious resource base against the wild resources. In early stages of food production, people simultaneously collected wild foods and raised domestic ones. However, the domestication in agriculture and livestock provided a considerable security and predictability in the human subsistence economy that fuelled population growth and expansion of the new and challenging environments (Zeder et al. 2006: 2).

The earliest human societies, having domestic animals, fed individuals in distinct ways. First, domesticated animals became directly the main source of animal protein that replaced wild games. In addition to meat, some domesticated mammals served as a source of milk and milk products, like butter, cheese, yogurt and ghee. Thereby, the milk-producing mammals yielded a variety of resources that were high in nutritional scale, and which could be replenished and stored. Those mammals produced several times more calories over their lifetime than they could if slaughtered and consumed (Diamond 2005: 88). Both, the meat and milk are derived from the organic material of plants ingested by the animals, but the humans are not biologically equipped to digest that. That, in a way, represents the most efficient possible use of the uncultivable land. However, when a person milks his lactating stock, he places himself at an earlier point on the food chain (in comparison to slaughtering their animals for meat alone). Nonetheless, the interception in this chain happened in such a way that it supported a far larger human population, than if the same proportion was deducted only after the animal's conversion to meat (Ingold 1988: 176).

Besides providing food and milk, the domestic animals also become a source of energy. Before animal domestication, the only means of transporting goods by land was on the human back. Large domestic mammals, like cattle, buffalo, yak, horse, donkey, reindeer, and the Arabian and Bactrian camels had brought about significant change in human society by becoming chief modes of land transport. Although small bovid, like sheep and goats have also been used for light traction over short distances, but those were not capable of heavy and long-distance transport. Than, it became possible to move not only heavy goods in large quantities, but also to carry people fastly overland for long distances. That led to the development of local and long distance trade network for the exchange of raw material, finished commodities and subsistence products. The most important contribution of that network was the exchange of people and ideas. Thus, the deployment of animals for transport might have been critical for the development of ancient complex societies. Likewise, harnessing animal power for different agrarian activities revolutionised the agricultural system. Animal-driven ploughs facilitated expansion and improvement in agriculture, for that made tilling of the difficult land possible. Furthermore, the early cultivators realised that animal dung could be used as manure to enhance fertility of soil.

Another important secondary product of the living animals is the natural fibre. The realisation of that fact by early pastoralists led to the production of wool. Pastoralists also learnt the advantages from diversifying their stockholding. They started to manage of several distinct species together, some of which might have been valued primarily for meat, while the others were kept for getting other secondary products. For example, large mammals, such as cattle and buffalo are prolific milk producers in comparison to small mammals, like sheep and goat. However, cattle and buffalo reproduce slowly, whereas the greater reproductive potential of sheep and goat permits a higher meat extraction rate. In addition, different animals are attacked by different diseases and, therefore, a diversified group of animals is less vulnerable to a number of epidemics. The diversification in stockholding also permits a fuller use of environment, as different animals seek different food plants. Moreover, in the pastoral economy, the presence of distinct types of stock creates the possibility of conversion from one to another through exchange (Ingold 1988: 176-177).

Finally, plant and animal domestication brought an important change in the sociocultural setting. The increased handling and the rising importance of living animals to human society gradually led to the higher values on livestock. The notion that some living animals could

be the object of human ownership changed the equilibrium between humans and other species. It resulted into a significant alteration in the relationship between humans, as the concept and issue of property emerged. That led to the differentiation within human society in terms of behaviour and power, ultimately leading to the complex systems of social stratification (Swabe 1999: 30). The realisation that animals were important to human society also led to the creation of spiritual beliefs. Now, animals signified affluence, authority and productivity; and accordingly those were revered, anthropomorphised and transformed into the objects of worship.

Animals in Society today

In modern society, it is very easy for the people to ignore the extent of their dependency on other animals. However, 'the animals have and will always form a central feature of the Human world' (Manning and Serpell 1994: xi). People may remain oblivious of, or choose to ignore, the vast majority of animals surrounding them, but these have a profound significance on them. In fact, the humans are dependent on other animals in various ways. It can even be argued that animals touch the life of almost every human.

While some people raise animals for food, others keep them for the secondary products. Today, thousands of different breeds of farm animals are available for various specific purposes and functions within the framework of environmental and socio-economic conditions. In the last century, farm animals have changed from multipurpose to single purpose animals. The majority of modern farm livestock are high yielding and specialised for only one purpose. (**Fig. 1.4**)

Fig. 1.4 Boar depicted as one of the incarnations of Lord Vishnu

In fact, many of us are dependent on animals to provide dietary protein as meat, dairy products and eggs. These form a significant part of the human diet. Even if the animal flesh and eggs are excluded from the human diet, milk and other dairy products play a very important role in the vegetarian diet. A number of ready-to-eat food products contain one or the other form of animal product. For example, most of the

confectionery items contain a substance called gelatine, which is a thickener obtained by boiling skins, tendons, ligaments and bones of the slaughtered animals and, glycerine (an animal product) is likewise used as a moistener and solvent for other food additives (Ockerman and Hansen 1988: 157, 198).

While the animals are kept to advertise status and prestige (as living adornments and as animated playthings or toys), humans also struggle to keep some animals (mice and rats) away from their houses. Some people may take pleasure from hunting them and some may feel delighted by watching them in the wild. Body parts of many animals have been used for various purposes, and the animal skins and furs of have been used to make clothes and other products.

Lately, it is commonly held that the interaction with pets can help to buffer people from the damaging influence of negativism and stress. The most frequently used present-day term is the 'animal-assisted therapy', now being commonly practiced in various nursing homes, prisons, psychiatric facilities and other institutional facilities. One can even find other terms, like 'pet therapy', 'pet psychotherapy', 'pet-facilitated psychotherapy', 'four-footed therapy', 'pet-mediated therapy' and 'pet-oriented psychotherapy' to describe the therapeutic uses of animals (Allderidge 1991: 759762). In addition, with the increasing sophistication in the medical sciences and biotechnology, new ways of modifying animals have emerged. For instance, pigs provide valves for human hearts, and the primary type of insulin used by the diabetics is developed from the pigs (Dawson 1998: 8).

Animals are incorporated into various religious traditions. In India, snakes and monkeys are respected and revered, and temples devoted to them can be seen all over the subcontinent. Several Hindu gods take the form of animals, such as Hanuman (monkey) and Ganesh (elephant). (**Fig. 1.5**) Vishnu, one of the Hindu deities, is believed to undergo incarnations as a fish, a tortoise and a boar before incarnating as Narsimha (a creature that is half-man and half-lion). Most of the Hindu gods and goddesses are depicted with animals as their mounts, such as Shiv with Nandi bull and snake, Durga with lion or Indra with Eravat elephants. (**Fig. 1.6**) Likewise, Ganesh is usually depicted with a mouse. The Buddhist *Jatak* tales are a set of 547 narratives of the Buddha's previous births, many of which were as various animals. Consequently, animals are frequently seen illustrated in the Buddhist art and sculpture. In addition, many religious texts impose a number of customary restrictions regulations on which of the animals should or should not be eaten. For example, the cow is sacred animal of the Hindus and its meat is not to be taken. Likewise, there are religious

prohibitions for consuming pork in the *Torah*, *Bible* and *Koran*, Islamic practices also exclude scavenging and the bottom-feeding aquatic animals from the diet.

Fig. 1.5 Animals as vehicles of various Hindu gods

Fig. 1.6 Elephant symbolism in Buddhism

Animals are also used in a variety of ways to provide human entertainment. People visit circuses to watch animals performing death-defying feats. People also take pleasure from gambling on the outcome of animal races, such as horseracing. Bullfights and bull games are some of the better-known forms of animal combats that the people have been enjoying through ages. One of the television channels has a popular programme 'The Animal Kingdom' that entertains many TV viewers. In fact, the entertainment industry covers an enormous range of the uses of animals. Animals in commercials increase sales and many nature-conservation groups use animals as icons for what those groups represent. Visiting zoos, zoological gardens or wildlife parks is a good way for enjoyment and spending time.

There is a big international market for wild animals and associated products. This includes eggs of the rare birds, live reptiles, birds and mammals, ivory, musk and various other products. A well-known

example is elephant ivory, which has always been the most popular of ivories, as it can be easily shaped. It has been used for carving figures, and for large, hollow objects, such as tankards.

The above account of the role of animals in present-day society is by no means a comprehensive account. We depend on animals in our everyday life in many more ways. In fact, ecological, psychological, cultural and utilitarian considerations are involved in interactions between people and animals. In other words, the nature of our relationships with other animals and the ways in which those are generally viewed mostly depend on how humans see themselves and their place in the pattern of existence (Manning and Serpell 1994: xi). The symbolic value of animals permeates all spheres of the human world. In India, animal tales, in particular the famous *Panchatantra,* are used for educating children. Incidentally, the 'piggy bank' originated in China, for pig is a symbol of wealth there (Dawson 1998: 5-8). The power of animal symbolism and representation can clearly be seen today in animal imagery that pervades today's society through mass media: advertisement and film. Animals are even an important part of our vocabulary that enriches our language. In fact, animals are universal key metaphors. Tilley says:

> The construction of principles of metaphoric analogy between the domain of humans and the domain of animals forms a fundamental basis for self-understanding and the construction of meaning in all known societies. Animals are key source domains and target domains of metaphors through which culture is constituted. Animals provide powerful metaphors with which to label human individuals or groups as superior or inferior.
>
> *Tilley (1999: 49-50)*

To conclude, it can be said that animals were, and still are, an element of the biophysical environment that is modified in numerous ways by human activity, particularly when the animals are incorporated into the cultural environment (Dawson 1998: 5).

2.

Dynamics of Animal Domestication

THE DOMESTICATION OF PLANTS AND ANIMALS IS ONE OF THE MAJOR human cultural innovations and it can be ranked in importance alongside the manufacturing of stone tools, the conquest of fire and the development of language. Domestic plants and animals are valuable to man not just, because he can grow and raise them when he wants and in whatever quantity desired, but primarily because those differ from their wild ancestors and relatives in the ways that greatly increase their usefulness (Chard 1975: 222). The subject of domestication attracts both, the scientists and the non-scientists alike, because domestic plants and animals provide most of our food today. Animal domestication, without any doubt, was the most important transformation in human-animal relations with the far-reaching consequences. Domestication was not only a prerequisite for the rise of civilisation, but that also transformed the global demography. However, domestication should not be confused with evolution. While evolution is considered a process that takes place naturally, without man's direct interference, domestication involves human control over breeding. Domestication can alter a species biologically and culturally, and it can instantaneously work in conjunction with the evolutionary process. While, the humans can indirectly influence the evolutionary process by causing a change in environmental conditions, the manipulation is not deliberate. Domestication has been a gradual process, and that process continues even to the present day, imperceptibly changing the behaviour, appearance and functioning of animal species, and consequently, the human relationship with them (Swabe 1999: 18). An understanding of the domestication process is necessary if one has to deal with issues related to ancient animal husbandry and other allied practices. Therefore, this chapter is devoted to understanding the different dynamics of animal domestication.

Defining Domestication and Domestic Animal

The body of literature dealing with animal domestication is enormous, but that is largely characterised by the confusing multiplicity of definitions. A number of those definitions create confusion rather than clarifying matters. In general, domestication means the process of transformation from the wild to domestic animals. The term is also used to denominate the domestic status of animals. The word 'domestic' is derived from Latin *domus* meaning 'house'. Therefore, a domestic animal or a plant is the one brought into the household to serve those who live there (Harlan 1992: 63). However, the term 'house' (*domus*) covers not only the residential space, but also includes the home-garden, barnyard, field, farm, orchard and ranch as well as the courtyards and all those structures associated with the residential area. Obviously, large varieties of animals are found in this larger house-complex. Should all those animals be considered as domestic animals; and what about zoo animals, circus animals, animals used in the experimental research centres, farm-raised game, fish and wild animals that are tamed? Faced with these difficulties, as Russell points out, scholars either try to define domestication in such broad terms that the term 'domestication' essentially becomes meaningless (Russell 2012: 208). Alternatively, they choose just some of the human-animal relationships, leaving the others in an ambiguous zone. Although, the scholars studying domestication are in fair agreement that animal domestication is a relationship in which man has control over animals, differences in opinion appear when the attempt is made to specify the extent to which an animal's behaviour must be controlled by the humans in order to classify that relationship as the one involving domestication.

Many scholars distinguish between taming and domestication. While taming is perceived as alteration in human-animal association with a particular animal that does not have long-lasting effects through successive generations, domestication is seen as long-term change in relations beyond the lifetime of a single animal resulting in morphological and behavioural changes (Russell 2012: 209). Even though taming was or is essentially a pathway in the direction of domestication, a tamed animal cannot be said to be a fully domestic one. According to Reed, a tamed animal is one that has been taken from its wild environment and it has learned by experience that humans are a source of food and shelter, rather than a source of harm (Reed 1984: 2). In addition, to tame and domesticate animals, a

domestic animal that is returned to the wild to survive and breed has been defined as a ‘feral’ animal. The feral animals were able to survive in the wild, as their natural instinct had only been modified, but not eliminated altogether during many years of control by man.

Various definitions of domestication are available, but essentially, there are two ways of defining a domestic animal. The first is based on biological aspect, where human control over breeding is considered the most crucial factor. Human-animal symbiosis is also considered central to the process of domestication. For example, Bökönyi (1969: 219) defines domestication as ‘the capture and taming by man of animals of a species with particular behavioural characteristics, their removal from their natural living area and breeding community, and their maintenance under controlled breeding conditions for profit.’ Similarly, Clutton-Brock (1994: 26) describes a domesticated animal as ‘one that has been bred in captivity, for purpose of subsistence or profit, in a human community that maintains complete mastery over its breeding, organisation of territory, and food supply.’ According to her, the end product of domestication is breed. That may be defined as a group of animals that has been bred by humans to possess uniform characteristics, which are heritable and distinguish it from other animals within the same species (Clutton-Brock 1994: 27).

The second manner of defining domestication is based on cultural and socioeconomic fabric of human society. Definitions of domestication focusing on the cultural side concentrate on the changes in the relationship not only between humans and animals, but also among humans themselves. These definitions do not emphasise on the role of animals in the human social spheres. For example, according to Ducos, ‘domestication can be said to exist when living animals are integrated as objects into the socio-economic organisation of the human group, in the sense that, while living, those animals are object for worship, inheritance, exchange, trade, etc’ (Ducos 1978: 53). This definition does not involve the concepts of control of breeding or the movement of animals. On the other hand, the essence of this definition is the conversion of animals into property. For Ducos, domestication brought a major conceptual shift in human attitude from relating the animals to just another species to treating them as assets. Ingold distinguishes three different forms of human-animal interactions and designates them as taming, herding and breeding (Ingold 1988: 82). He states that tame animals may be domestic in the sense of their incorporation as members of human households, but need not be morphologically domesticated. In a similar way, Meadow sees animal domestication as a change in focus on the part of humans from the dead to living animals and, more particularly, from dead animal to the

principle product of the living animal—its progeny (Meadow 1989a: 81).

Probably the oldest theory about why humans started domesticating animals is V. Gordon Childe's (1929) oasis theory. He coined the expression 'Neolithic Revolution' to highlight the importance of domestication of plants and animals. Childe suggested that after the glaciations, North Africa and southwest Asia became drier. That forced humans and the potential domesticates to converge in area where water was available. That resulted into a symbiotic relationship between the animals and humans. Humans first learned the behaviour of animals that congregated around them and then gradually domesticated them. While that theory had an appealing explanation for origin of domestication, it is now known that the climate may not have been as harsh as Childe had imagined. Since him, many hypotheses have been put forward to explain the origins of agriculture and animal domestication.

Some cultural geographers hold that interest in supernatural and magical rituals grew among humans with the development of settled societies and agriculture. Settled life, the stability of plant life and enough leisure allowed elaboration of that interest and led humans to perform sacred rituals involving sacrifice of animals that subsequently led to the domestication of animals. However, that religious idea of animal domestication is not accepted by all scholars, e.g., Rodrigue (1992: 427-428). Braidwood (1957) suggested that domestication occurred as the natural result of steadily increasing cultural differentiation, which began in the early mesolithic phase. Although these arguments, suggesting the animal domestication began among incipient agriculturalists, are stimulating but not convincing enough. It is quite possible that the hunting nomads living in close association with animals may have domesticated some animals. The apparent refusal of some hunters to practice domestication and adapt a pastoral way of life when it is offered to them is not indicative of their incapability to domesticate. Various scholars have also pointed out that settled life was not an obligatory precondition for domestication.

Cohen developed an elaborate 'population pressure model' to explain the origin of agriculture and domestication (Cohen 1977: 18-72). He argued that domestication was a necessary and intentional adaptation by humans to cope with the crisis created by overpopulation. He explained that this increased population pressure after the last Ice Age resulted in the decline of environmental productivity and a reduction in the nutritional adequacy of the human diet. That forced humans first to deliberate cultivation of crops and successively to the domestication of

animals. Binford and Flannery combined the ‘population pressure’ and ‘sedentary hypotheses’ to form what is called the ‘marginal zone hypotheses’ (Binford 1968: 313-341; Flannery 1969: 73-100). They suggested that the stress situation caused by overpopulation might have been a stimulus for such developments. They envisioned some sedentary communities who moved out to marginal zones as populations grew. They became farmers not only because of population pressure, but also because they were sedentary and in direct competition with the other gathering people. However, some scholars rejected the view that such pressure arose only during the Holocene. On the other hand, they believed that such occurrences were naturally frequent throughout prehistory.

In the light of current evidence, it may be seen that the food producing animals (sheep, goat, cattle, and so on) were domesticated earlier than transport animals (horse, donkey, camel, and so on). This shows that there was need for a regular food supply for the growing population. Therefore, growing population seems to be the prime motivating factor for animal domestication. Domestication of plants and animals certainly allowed a larger number of people to sustain themselves over a piece of land than on hunting and gathering. According to Sahu, ‘Given the prehistoric hunter’s knowledge of ecology, the introduction of domestication must have been related to its adaptive advantage when domestication produced greater yields than did hunting; it would have been economically more efficient to pursue that course’ (Sahu 1988: 39).

The Consequences of Animal Domestication

The domestication of plants and animals, as advocated by Childe (1929) was a major cultural revolution. This view is, however, rather an elusive one. Recent researches have shown that the agrarian regime necessitated radical change for the people, who adopted it and was perhaps not a great step for humankind as it was once thought to be. Intensification in agricultural activities led to the clearance of forests or vacant lands and, in a way, reduced the range of undomesticated territory in which people could hunt and gather food. According to Goudsblom, agriculture gradually became the only mean of subsistence, as it directed to the eradication of other systems of obtaining food (Goudsblom 1989: 21-22). Thus, once agriculture had been well established, there was no way of reverting to the old manner of subsistence (Swabe 1999: 30).

In contrast to the relatively straightforward hunting-and-gathering ways of life, domestication gave rise to considerable work like tilling the land, harvesting of crops and taking care of domestic animals on a regular basis (Swabe 1999: 30). In addition, whereas a hunter-gatherer society can shift from one food source to another in the time of drought, flood, heat wave or frost, framers throughout history have tended to rely on a handful of crops and animals (Budiansky 1992: 119). This easily digestible food of *Homo sapiens* gradually led to the shrinking of the human jaw. The human jaw now can accommodate only 28 teeth and the wisdom teeth create a number of problems when they erupt. During the last 10 thousand years, *Homo sapiens* is shrinking in size from the Cro-Magnon's height of six feet, the average human height is now 1.73 m (5 ft.-8 in.) today. Even the brains of modern humans are shrinking. Dependence upon an agricultural mode of production has greatly increased health risks. Similarly, carrying heavy loads may cause skeletal deformities. Maize cultivation, which started 8000 years ago by the native (pre-Colombian) American Indians, resulted in a great increase in tooth cavities, anaemia, TB, yaws, arthritis and syphilis (Agrawal and Kharakwal 2002: 81-83).

If domestication of plants and animals brought such miseries then, one may ask, why humans did it. The development of farming and animal husbandry certainly allowed a larger number of people themselves to sustain using a piece of land, than would have hunting and gathering. The chief advantage of agriculture was undoubtedly an intensive production of food, which assisted in supplying the nutritional needs of

ever-growing populations. The increased control over the natural environment, which the domestication of both plants and animals offered, ultimately led to the increased availability of food, and consequently to increase in human numbers. In order to feed the growing human population, more food was required, and a self-sustaining and creating cycle set in.

Biological Nomenclature and Taxonomic Position of Domestic Animals

Since an in-built continuity exists between domestic animals and their wild progenitors (for example, the domestic horse and wild horse) it is necessary to describe briefly the fundamentals of animal taxonomy (the science of classification and nomenclature). The most fundamental aspect of any taxonomic work is description and classification, where one uses a standard set of attributes. That standard set has to be objective, logically independent, precisely defined with non-overlapping meanings. However, there are a number of problems that make application of a standard set of a classificatory system to domestic animals difficult.

Early explorers who gathered organisms from around the globe were faced with the difficulty of classifying those organisms. The first major classificatory scheme was created by Carolus Linnaeus. At first, Linnaeus tried to use a 'natural' classification by dividing the living organisms into two major groups (kingdoms) which he called plants and animals. However, that scheme quickly gave way to a more arbitrary set of criteria. He developed seven levels of groups within each group: the kingdom, phylum, class, order, family, genus and species. Within that scheme, Linnaeus followed the practice of naming each unique form of an organism by its genus name (for example '*Canis*' for dogs, jackals, wolves) followed by a species name. The species name added more information and clarified the reasons that made particular organism special. For example, to the wolf he gave the name *Canis lupus* (meaning a member of the genus *Canis* with a brindled grey coat, which lives in the woods). It meant that every unique organism could be unambiguously named by using two words only. That system is known as the 'binomial nomenclature'. This binomial system of naming brought an end to the chaotic world of common names that frequently occurred in the zoological literature earlier. Common names had two problems. First, the common name varied from country to country, and from region to region within a country. Additionally, some species literally had hundreds of different common names. Secondly, many common names referred to higher taxonomic category, such as the catfish. A common name, even if one recognises it, often does not specify a particular species.

The Linnaean system of classification, in a highly modified form, has persisted to this day and it is still popularly used. The binomial system

of nomenclature is universal and clearly indicates the level of classification involved in any description. No two kinds of animals have the same binomial name, and every animal has only one correct name, as required by the International Code of Zoological Nomenclature (ICZN), thus evading the muddle that common names cause. The genus of an animal begins with a capital letter, the species designation begins with a lowercase letter, and the entire scientific name is italicized or underlined because it is derived from the Latin or is Latinised. Thus, the scientific name of humans is written as *Homo sapiens*. When the genus is understood, the binomial name can be abbreviated like this: *H. sapiens*.

In the tenth edition of the *Systema Naturae*, Linnaeus (1758) gave names and descriptions to more than 4000 organisms, amongst which were included all the domestic animals. However, later on it was realised that there are a number of discrepancies that make it difficult to apply the binomial nomenclature of the Linnaean system to domestic animals. For example, when Linnaeus was familiar with both wild and domestic form of species and they looked alike, he gave them the same name. On the other hand, he gave separate names to wild and domestic species in cases of his unfamiliarity with the relations of these species. For instance, as he was not aware that wolf is the progenitor species of dog, he gave them separate species names: *Canis lupus* for wolf and *Canis familiaris* for dog (Clutton-Brock 1987: 194). Now it is known that the wolf is the ancestor (species) of the domestic dog. These examples not only show the inconsistencies in the Linnaean system of classification, but also highlight the dilemma that scholars are still facing today. Scholars are still unable to answer the question —'whether domestic animals should be treated as taxonomically identical with their wild progenitors or not.' It has even been suggested that domestic animals should be excluded from formal zoological nomenclature.

In recent years, the ideas of 'what a species is' have changed and have become more complicated. Scholars are now aware of the fact that domestic animals and plants, even though they have biological affinities, have undergone several modifications. They now know that domestic animals are integral parts of other animal groups from which they were derived as separate entities. Therefore, in describing species, taxonomists now use various criteria that are morphological, physiological, embryological, molecular and ecological, realising that all of these have a genetic basis. Of late, several concepts regarding species, such as the evolutionary, phylogenetic, and cladistic, etc. have been proposed. All these species concepts are based on the premise that different species can be distinguished from one another in

terms of evolutionary terms of organisms. Scholars also devised different systems of nomenclature for the domestic animals to overcome the difficulties that the Linnaean system presented. However, none of those received international recognition. For example, Bohlken proposed a scheme, in which he tried to link the domestic form of animals by using the word 'forma' with the first available name for the wild species such as *Canis lupus* f. *familiaris* for domestic dog (Bohlken 1961: 107-113). However, the scholars found that system cumbersome and disadvantageous. They felt that the new scheme assumes certain identification of the wild ancestor species, which for some domestic animals was difficult to establish at that period of time (Clutton-Brock 1987: 195).

For the present book, we have used the latest versions of animal names. In some cases, this may cause confusion, as many primary texts still use the older version. The scientific names for the major domestic animals that have been discussed in this book are listed in Appendix 1.

3.

A Short History of Domestic Animals

SO FAR, WE HAVE REVIEWED THE BASIC CONCEPTS RELATED TO THE animal domestication, we now turn to those animals that, in the course of time, underwent significant transformation by their association with the man, and in that process became domesticated. In this chapter, the available information on the history of major domestic animals is briefly reviewed based on the available information gathered from the archaeological findings, genetic investigations and the literary data.

Dog (*Canis familiaris*)

Domestication of dog, one of the most popular companion-animals of the man, has been slightly different from that of the other animals. The domestication of dog started several thousand years earlier than that of any other mammal, and probably that later on provided essential lesson for the domestication of other animal species. Domestic dogs can be viewed as one of the humankind's largest and longest running breeding experiments. With over 400 breeds currently recognised, the domestic dog has been an unassuming accomplice in possibly the most convoluted and extensive genetic experiments ever conducted. Each of these breeds owes its existence to artificial selection by man and it exhibit considerable differences in behaviour and physiology. Today, dogs are found in every region of the inhabited world, and it is hard to assess their overall usefulness and economic importance. (Fig. 3.1) The dog is uniquely placed in human culture, as no other domesticated animal enjoys as much love, affection and friendship of the humans as the dog does.

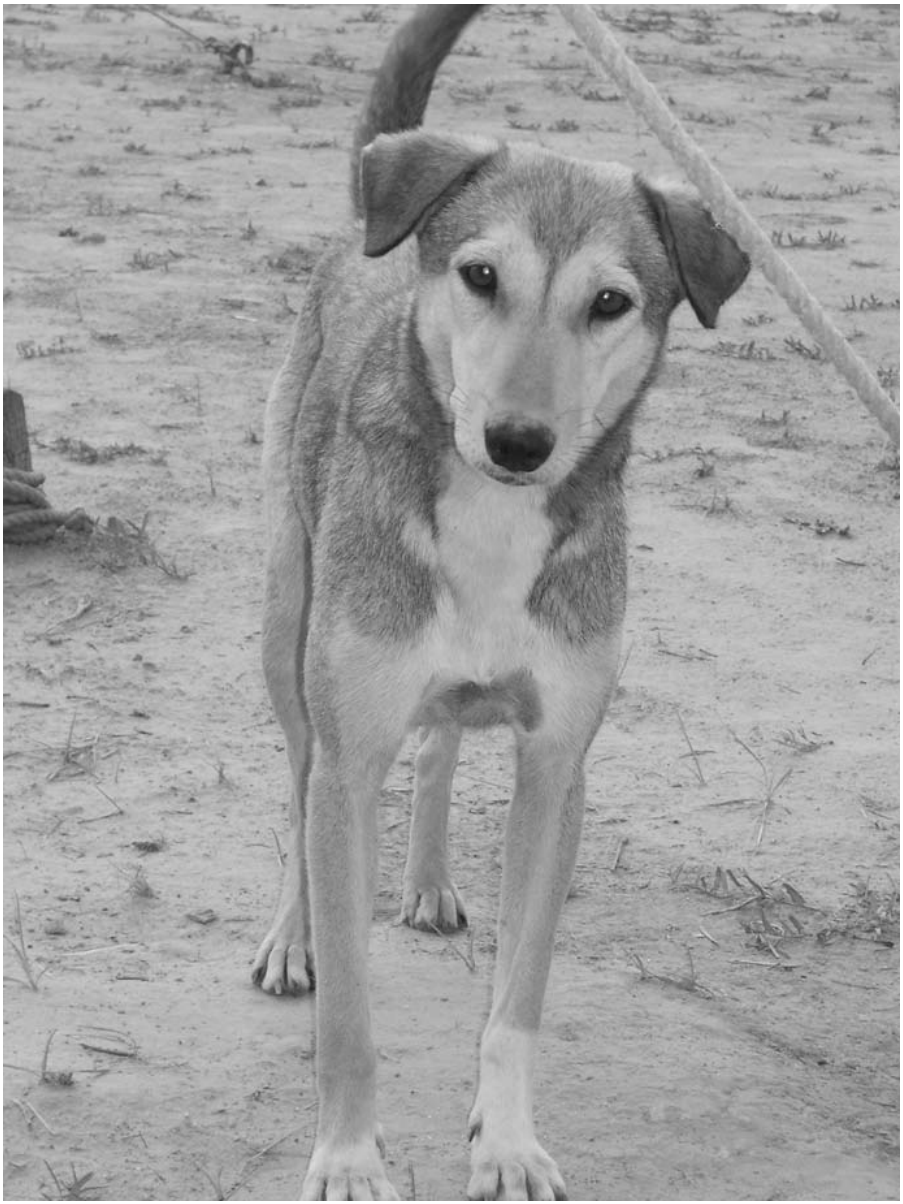

Fig. 3.1 Domestic dog

The wild species most closely related to the dog belong to genus *Canis*. The conventional thinking has been that the wild canids might have scavenged kills left behind by the humans, as they moved on in search of new game. Gradually those animals became accustomed to human contact, and that situation led first to a commensal and then to the symbiotic relationship with the humans. That provided the opportunity for a close individual relationship between the young animal and a human. Thus, a fully domesticated dog finally evolved

over many generations.

Until rather recently, there have been many debates relating to the dog's ancestor. In view of the huge phenotypic diversity exhibited by the domestic dogs, the key point of debate was whether a single or several wild species were responsible for today's dogs. To the genus Canis belong the species of grey wolf (*Canis lupus*), red wolf (*Canis rufus*), coyote (*Canis latrans*) and the jackals (*Canis aureus*, *Canis adustus*, *Canis mesomelas* and *Canis simensis*). Some studies suggested that the domestic dog originated from the grey wolf and jackal, each of those wild species giving rise to the different breed. However, most of the recent studies have shown that dog matches the grey wolf better than any other species. One of those studies has indicated that the dog and the wolf share 98% of their mtDNA (Vila et al. 1997: 1687-1689). The exact timing of domestication of dog is still a matter of debate. Archaeological evidence (including co-burials of humans and dogs) and molecular studies of mtDNA from wolves and domestic dogs suggest that dogs evolved in many regions worldwide, though the timing of those events is still debatable.

Until recently, the oldest archaeological evidence for the domestic dog was from Eliseevichi I, a central Russian site. That site revealed two 13,000 to 17,000 years old skulls of domestic dogs (Sablin and Khlopachev 2002: 795-799). More recently, an analysis of a number of large canids from the upper Palaeolithic sites in Belgium, Ukraine and Russia yielded the evidence of prehistoric dogs (Germonpre et al. 2009: 473-490). Remarkably, the radiocarbon dates places one of those prehistoric dog skulls at approximately 31,700 years before present (BP). Those results clearly suggest that dog domestication has already started during the upper Palaeolithic period. However, some scholars raised question that evidence. They argued that hominids might not have had the mental ability to project themselves in a complex programme of domestication at such an early date. On the other hand, those scholars like to call that as an evidence of the process of proto-domestication to distinguish that from the real domestication process that has been dated around 14,000 BCE.

DNA studies place the divergence of dogs and wolves either at 100,000 to 140,000 years ago or between 15,000 to 40,000 years ago (Vila et al. 1997: 16871689; Savolainen et al. 2002: 1610-1613). Those DNA results, even more controversial than the archaeological ones, were supported by the considerably larger datasets than many estimates of human ancestry. However, the claim that the separation of the dog from the wolf occurred over 100,000 years ago have been criticised by many archaeologists, zoologists, biologists and even by

some molecular geneticists, on a number of grounds.

Michelle Jeanette Raisor, in her Ph.D. dissertation, has proposed an alternate theory on dog domestication, based on the combination of molecular genetics, behavioural studies on modern wolves and archaeological records. She hypothesises that dogs diverged from wolves over 100,000 years ago independently of man, as an adaptation to the changing environment. Those animals evolved both genetically and morphologically without the benefit of artificial selection. Those genetically and morphologically different canids began to live in close proximity with humans at around 15,000 years ago, as can be seen from the archaeological records. However, the animals that early man domesticated were not wolves, but primitive dogs (much smaller in size and less threatening than wolves).

While the canid bones recovered from archaeological sites have revealed differences in the sizes of prehistoric dogs, the formation of distinctive dog breeds seem to be a much recent phenomenon. Dog breeding and distribution were highly influenced by the humans. The genetic studies have suggested that most of the current dog breeds may represent a recent radiation from a common stock.

A look into the above account shows that while the origin of domestic dogs from wolves has been clearly established, the number of founding events (as well as where and when these occurred) have not been properly recognised. The dates for the origin of domestic dog (15,000-140,000 years ago) are based on a number of assumptions that leave the time of the origin of dog and its domestication in question. Both archaeological and genetic approaches provide an alternate view of dog domestication that not only stimulates further research, but also reveals the complexity of dog domestication models.

Cat (*Felis catus*)

Domestic cats have intrigued people throughout the world for centuries. (Fig. 3.2) They have not only been treated as the revered creatures, but also have been considered as the objects of fear and superstition. In fact, cats are still mysterious animals and slightly beyond the total understanding of human being.

Fig. 3.2 Domestic cat

Unlike other domestic animals, domestic cats are territorial, generally solitary and hyper-carnivorous. These virtually contribute nothing by way of sustenance or work to human endeavour. Additionally, nearly all domestic cats can survive and even flourish on their own. Therefore, the question, 'how cats become such common pets in households.' has fascinated scholars for a long time. Archaeological remains and anthropological data suggest that the cat most probably began its association with the humans as a commensal species by feeding on rodent pests, infesting grains stores of the earliest farmers. Driscoll et al. say:

> It is almost certainly the case that mice attracted the cats. But the trash heaps on the outskirts of town were probably just as great a draw, providing year-round pickings for those felines resourceful enough to seek them out. Both these food sources would have encouraged cats to adapt to living with people; in the lingo of

> evolutionary biology, natural selection favoured those cats that were able to cohabitate with humans and thereby gain access to the trash and mice.
>
> *Driscoll et al. 2009: 60.*

As cats were already well adapted to preying on rodents, artificial selection was largely unnecessary. Therefore, cats retained many of the morphological and behavioural traits of their wild ancestors even as they spread to various parts of the world.

While the domestic cat may be the most numerous pet of the world, little is known about its origin. The cat belongs to the genus Felis, which also includes various other species and sub-species. All house cats worldwide belong to this genus, and these are known as Felis catus. Until recently, scientists had no way of determining unequivocally which of the wild cat populations gave rise to the domestic ones. A wide-reaching molecular genetic study based on mtDNA of the world's domestic cats and wild cats by Driscoll et al. has shown that all domestic cats are descended from the Middle Eastern wildcat (*Felis silvestris lybica*) (Driscoll et al. 2007: 519-523). Their analysis also revealed that domestic cats arose in a single locale, the Middle East, and not in other places where wild cats have been common. More specifically, it would be related to the early days of agriculture, which ushered in settled farming and stock keeping. However, mtDNA could not be used to estimate the timing of the split between the domestic cats and the wild cats.

Although the exact timeline of cat domestication is not known, yet archaeological evidence has provided some insight into the process. Cat remains have been found in association with the humans at several neolithic sites. The oldest direct evidence of cats in association with the humans dates to 9,500 years ago in Cyprus and at sites in Israel (9,000 years ago) (Driscoll et al. 2009: 56-76). A number of Indus sites in India have also revealed the skeletal fragments of domestic cats. However, it is the Egyptian paintings (dated around 3,600 years ago) that provide the oldest known unmistakable depictions of the domestic cats. Those paintings show cats poised under chairs, sometimes collared or tethered, and often eating on bowls or feeding on scraps. In fact, the cat was one of the most sacred of all animals to the ancient Egyptians. They were even mummified in enormous numbers 2,900 years ago (Clutton-Brock 1987: 110).

As Clutton-Brock (1987: 111) has suggested the relationship between the cats and humans is more symbolic and mutually beneficial than that commonly found between any other animal and man. In addition

to clearing the household from unwanted scavenging animals such as rats and mice, cats provide humans with warmth and affection. At the same time, cats play an important role in witchcraft, sorcery and various other cult practices. However, it is surprising to see how little domestic cats differ from the wild cats, bearing in mind the long time over which the man has been associated with the former. Therefore, are today's cats truly domesticated, according to Driscoll et al., 'yes, but perhaps only just' (Driscoll et al. 2009: 63). They say that the domestic cat has not stopped evolving and it may be on the verge of an unprecedented and radical evolution into a multispecies composite whose future can only be imagined.

Sheep (*Ovis aries*)

Sheep, together with goats, have been the important livestock species in the world. (Fig. 3.3) Since those were domesticated, the sheep have contributed to the sustenance and comfort of human society. At present, sheep contribute significantly to world needs for food, particularly meat. In addition, many breeds of sheep produce wool, besides fibre has been the primary product from these. Sheep manure is better than cattle manure and penning of sheep in harvested fields enhances soil fertility, for their droppings contain rich nutrients. Sheep possess a special ability to thrive on the natural grasses. In fact, there is no substitute for sheep as a class of livestock for utilising wastelands or field weeds. Sheep by nature are gregarious animals, and unlike goats, are generally uniparous.

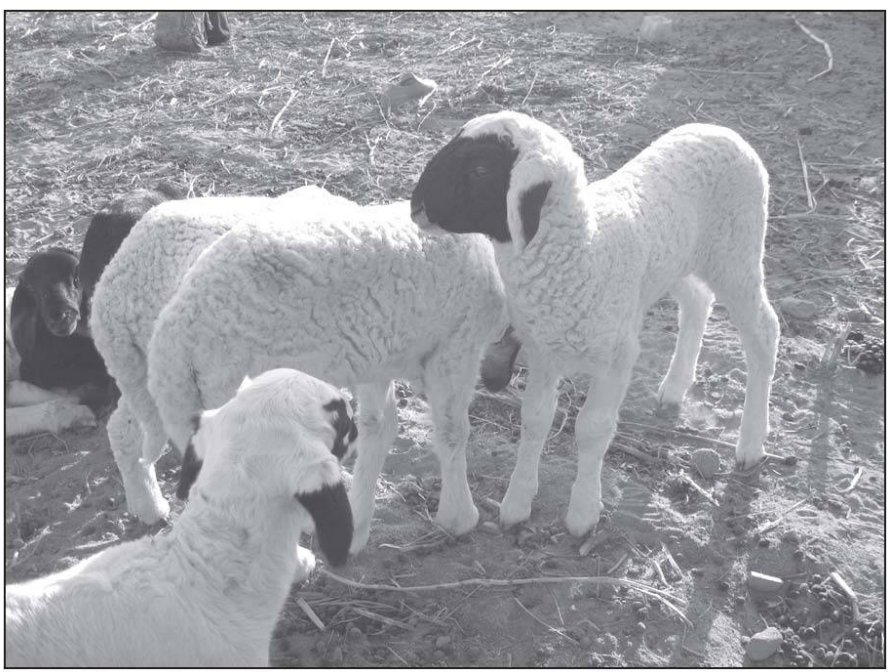

Fig. 3.3 Sheep

According to Ryder, 'The domestication of sheep (and goats) was an unconscious and gradual strengthening of an association between two social species (man and sheep), pre-adaptive by their respective evolutions to be of mutual benefit' (Ryder 1984: 67). Indications of the process of domestication of sheep (and of goats) come from the ethnographic and animal behaviour studies. The submissive behaviour

of these animals enabled a personal relationship to develop between these animals and the humans. Detailed behavioural studies conducted on the wild sheep of North America showed that the humans could associate with sheep and goats in an easy manner (Clutton-Brock 1987: 55). The social structure of sheep and goats, based on a dominant hierarchy, would also have presented a useful trait that made humans to domesticate those animals. The calm temperament of those animals would have allowed humans to constrain those easily within a fence. While those considerations highlight the preconditions on the animal's side of the domestication process, it is also obvious that more or less conscious processes from the human side finally led to the incorporation of those animals into the revolutionary new subsistence practices. Clutton-Brock suggests two ways by which domestication of sheep and goat might have taken place. One of that is by herding and controlling the wild flocks in a favoured situation, such as near a water source, simply by habituation of a herdsman with a group of wild animals, and the other is by taming and rearing the young animals that mentally imprinted man as their leader (Clutton-Brock 1987: 56). Likewise, Ryder notes:

> Young animals may have been caught as hunting decoys or as pets, and suckled by women, a practice with modern ethnographic parallels. A man could have returned home with a lamb, and his wife then raised it with the children. The young animal would become attached to the foster mother by the process of 'imprinting'. Such imprinting must take place within a few hours of birth, a human wet-nurse would have been essential. The key to domestication therefore was not man the hunter, but the woman in the home.
>
> *Ryder 1984: 67.*

The domestication of sheep took place in southwestern Asia about 12,000 years ago and, thus, it represents the earliest of the livestock to be domesticated. The main home of wild sheep today is the mountain ranges of central Asia, from where it extends westwards into Europe, and eastwards into America (Ryder 1984: 63-64). Sheep taxonomy is ill defined and one frequently encounters a confused nomenclature of subspecies. By comparing the mtDNA data of the ancestor species for domestic sheep, at least five wild species of sheep are recognised. Of those, three: the Asiatic mouflon (*Ovis orientalis*), the urial (*Ovis vignei*), and the argali (*Ovis ammon*) are regarded as the potential ancestor species. However, Hiendleder et al. found that sheep were most likely to be descended from one or more Asiatic mouflon populations, and they ruled out the urial and the argali as the potential domestic ancestors of sheep (Hiendleder et al. 2002: 893-904).

Several reports have further analysed the geographical distribution of sheep haplotypes. Those reports revealed the possibility that now-extinct populations of wild sheep, possibly most closely related to the modern Asiatic mouflon, provided the domestic founder stock. Evidence of the mtDNA also suggests that there were at least three domestication events (or possibly recruitments) for sheep within the area of distribution of the wild forms between the Mediterranean and the Indus Valley (Pedrosa et al. 2005: 2211-2217). The genetic evidence of three distinct lineages in domestic sheep is in line with mounting archaeological evidence of the multiple domestication events of this species.

The earliest archaeological evidence for sheep domestication comes from the northeastern Iraq and southeastern Anatolia that can be dated to 12,000 years ago. The faunal assemblages at those places show an almost exclusive focus on two to three year old males. Those evidence pertain to an older age bracket than expected with herd management, but younger than expected with hunting (Zeder 2008: 11598). According to him, 'The proposed scenario suggests that, rather than broadening the prey strategy to include both males and females, hunters conserved female breeding stock, while relying on the steady immigration of younger males drawn from surrounding territories to fill the vacuum left by the kill-off of local prime-age males.' A number of other sites in the Fertile Crescent region have given evidence of the increasing hunting strategies into management of domestication of sheep over a period stretching from about 10,000 to about 8,500 years ago (Zeder 2005: 141). In South Asia, the only evidence of sheep domestication came from the site of Mehrgarh. Elsewhere in South Asia, the nature of this transformation is not clear.

The changed environment following domestication of sheep allowed a greater range of variation to survive through natural selection. As sheep were not indigenous wild animal at many places of the world in the post-Pleistocene period, people might have taken those there. The migration of people in different places allowed more outbreeding, resulting in many more different breeds than was possible in the wild state. However, to assess the timing of onset of widespread intercontinental movements of sheep lineages, and to identify and track and diffusion routes of those lineages, future research needs to include more archaeological sites from different periods and regions. India's vast genetic resources in sheep are reflected by the presence of more than 30 breeds of sheep. These can be broadly classified into three main types: the temperate Himalayan region sheep, the northwestern region sheep, and the eastern region sheep (Banerjee 1991: 796).

Goat (*Capra hircus*)

The domestication of goat was an integral part of the rise of agriculture and adoption of its practices throughout the world. The domestic goat is quite often dismissed as the 'poor man's cow' for its ability to thrive on meagre fodder and cope with harsh environments. However, the adaptation of goats to harsh conditions and their versatile feeding habits probably enhanced their success as a domestic animal. Goats are extremely hardy and will thrive and breed on a minimum of food and under extreme conditions of temperature and humidity (Clutton-Brock 1987: 58). Whereas sheep are grazing ungulates, goats are browsers. Therefore, goats generally complement a flock of sheep by browsing on thorny scrubland, whilst the sheep prefer grass (Clutton-Brock 1987: 58).

The wild progenitor of domestic goat (*Capra hircus*) is the bezoar goat (*Capra aegargrus*). However, some scholars suggest that the markhor (*Capra falconeri*) may have contributed as a goat progenitor in eastern Asia. The geographical range of the bezoar goat parallels to that of the Asiatic mouflon. It lives in high, rocky mountain regions extending from the Taurus Mountains of Turkey into Pakistan (Zeder 2006: 181).

Archaeological attempts to document the domestication of goats dates back to at least 50 years, when systematic investigations to understand different aspects of farming and herding began in the Fertile Crescent. While debates continue over the relative utility of various archaeological markers used to document the earliest stages of goat domestication, archaeological work in the western and central portions of the Fertile Crescent has produced significant data on the domestication of goats. The earliest archaeological evidence of domestic goats comes from Turkey and the Zagros Mountains of Iran and Iraq that can be dated to roughly 10,500 to 9,500 years ago. In this regard, Zeder and Hesse notes,

> The long-term concentration on the hunting of the wild goats in the highland Zagros region seen in assemblages as far as the middle Palaeolithic suggests that the eventual domestication of goats grew out of a long-term process, in which hunting strategies evolved into the actual management of captive animals'.
>
> *Zeder and Hesse 2000: 2257*

Genetic studies on goats suggest three independent domestication events. At least two of those were likely to have occurred in the Fertile

Crescent, and the third region was perhaps within the Neolithic culture of Baluchistan in the western Pakistan (Luikart et al. 2006: 294-305). New and rare mtDNA lineages have also been uncovered in India and Pakistan (Sultana et al. 2003: 417-421; Joshi et al. 2004: 454-462). However, based on the analysis of mtDNA sample from the modern populations of the bezoar goat across the Middle East, it is suggested that there were only two significant centres of goat domestication: one in southeastern Anatolia or northwestern Zagros, and the other in southeastern Iran (Naderi et al. 2008: 17663). Nevertheless, it is important to note that inferences about the location of origin from a single type of molecular data should be made cautiously, as these can be unsatisfactory and even potentially misleading. It is advisable to incorporate information from several analyses, such as the geographic distribution of lineages and historical or temporal distributions by using ancient DNA data. Further molecular analyses of the autosomal and Y-chromosomal diversity of goats will certainly offer excellent perspectives to develop the history of the goat's domestication and its subsequent migration.

Once domesticated, goats (and sheep) were dispersed widely around the globe by the humans. At present, there are 20 breeds of goats in India, which provide a dependable source of income to 40 percent of rural population. (Fig. 3.4) However, majority of these breeds do not have specified or defined characteristics. Some of the well-known breeds of India are Jamnapuri, Barbari, Amritsari, Surati and Marwari. Most of these breeds have developed over the years by artificial selection for meat purpose. However, a few dual-use breeds (used for both meat and milk) have also been developed in the subcontinent.

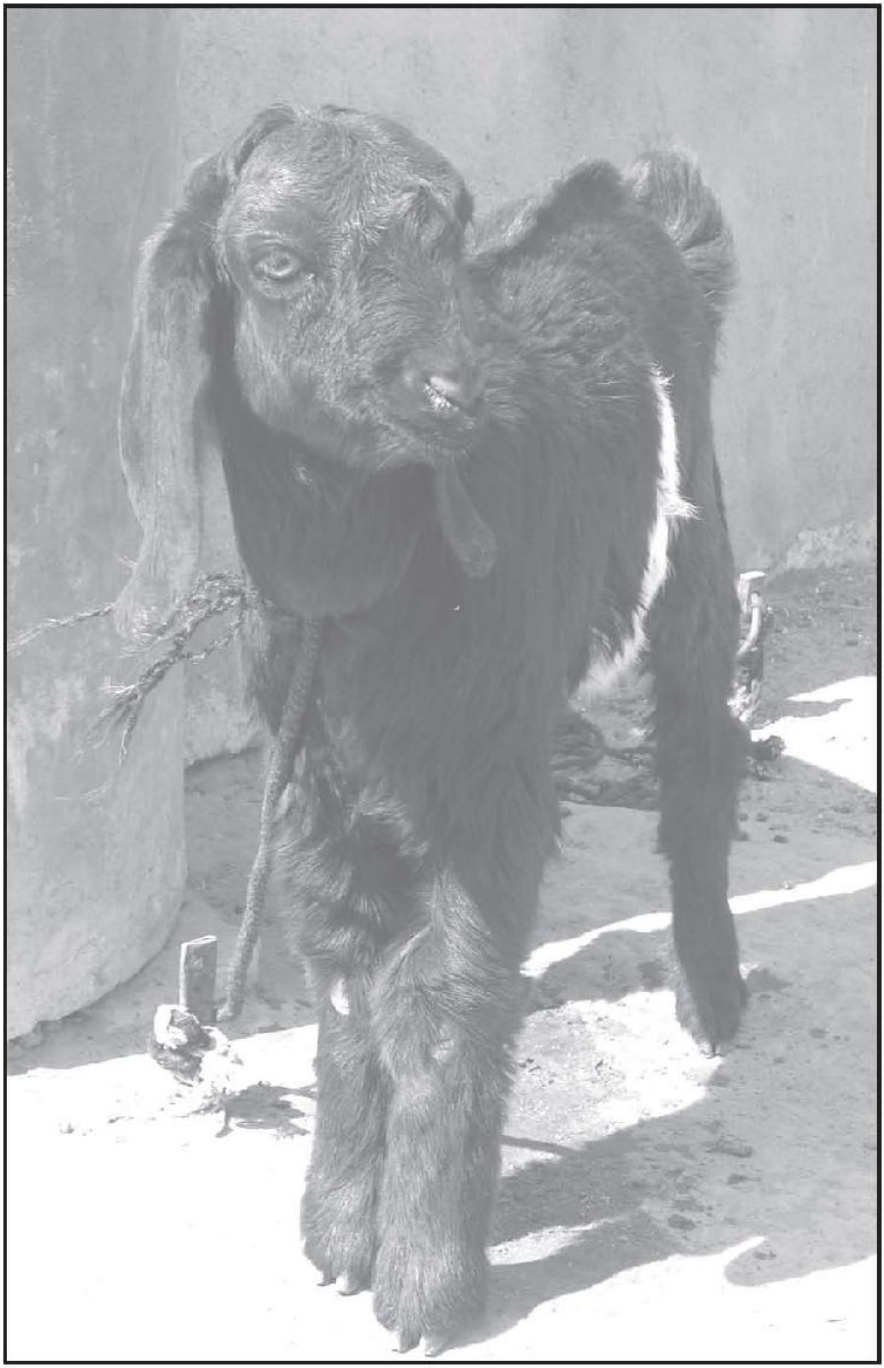

Fig. 3.4 Domestic goat

Cattle (*Bos indicus and Bos Taurus*)

No other animal provides such a versatile range of products as the domestic cattle do. At present, there are approximately 1300 million cattle distributed all over the world, constituting of approximately 800 separate cattle breeds (Bradley and Cunningham 1999: 15-31). That makes cattle the most numerous and economically important of all the domestic animals. Taxonomically, the domestic cattle can be divided into two types: *Bos taurus* (the taurine) and *Bos indicus* (the zebu) (Fig. 3.5 and Fig. 3.6). There is no uniform opinion whether these should or should not be considered separate species. They freely interbreed, so there is no reproductive barrier. However, there are obvious physical differences. Zebu cattle, found in the hot-arid or semi-arid regions of South Asia and Africa, are characterised by a prominent hump, long face, usually steep upright horns and a dewlap. On the other hand, the taurine cattle predominate in the temperate lands of Europe, West Africa, the Americas and the northern Asia. It is no exaggeration to say that the *Bos indicus* and *Bos taurus* have played important role in shaping civilizations, mainly through the innovation of milking and the land cultivation, using plough. Zebu cattle are frequently depicted on the seals recovered from the various sites of Indus civilization.

Fig. 3.5 Kanrej breed of zebu cattle from Kachchh, Gujarat

Fig. 3.6 Humpless cattle from South India

Domestication of cattle followed the incorporation of sheep and goats into the human subsistence economy. However, very little is known about the actual process that led those animals to domestication. It is generally presumed that having sheep and goats might have created the intellectual space for consciously adding those animals to the existing herds. Early domestic cattle were perhaps kept with little control when compared with the modern standards. Since, there is very little archaeological evidence for fencing; it may be presumed that the earliest strategies for keeping cattle might have involved free roaming of the herds, without any confinement (Clutton-Brock 1987: 67).

It is believed that all modern domestic cattle breeds derived from the now extinct wild aurochs (*Bos primigenius*). Those aurochs ranged from the west coast of Pacific through Asia and Europe to the eastern

coastlands of the Atlantic Ocean, and from the northern tundra southwards into India and North Africa (Epstein and Mason 1984: 7). Three continental races of those aurochs have been identified based on the morphological differences in the fossilised horns and the body shapes: the Asiatic (*Bos primigenius namadicus*), the European (*Bos primigenius*) and the North African (*Bos primigenius opisthonomus*) (Loftus et al. 1994: 2757-2758). It has been postulated that both, the *Bos taurus* and the *Bos indicus* were derived from the western Eurasian aurochs within southwestern Asia during the early neolithic development of pastoralism. Within that scenario, many scholars believed that zebu cattle developed from the taurines, subsequent to the original domestication event. However, a more recent view is that zebu cattle were domesticated independently from a biologically distinct wild progenitor within the Indian subcontinent.

Since then, the work has been focused on documenting genetic diversity within *Bos taurus* and *Bos indicus*. Genetic studies for *Bos taurus* suggest that this species was domesticated in the Near East. This pattern is consistent with the archaeological evidence, which correspondingly show that the taurine cattle were domesticated from wild aurochs approximately 10,000 years ago in the Fertile Crescent. Archaeological evidence also suggests that domestic animals spread to Europe from the Near East during the early part of the seventh millennium BCE (Pinhasi et al. 2005: 410). Genetic studies for *Bos indicus* suggest that there were two or more separate loci of domestication of *Bos indicus* in South Asia (Magee et al. 2007: 385-391). Those results indicate multiple domestication events in different parts of South Asia and the spread of those domestic animals to the new areas within and outside of the subcontinent. The faunal remains from Mehrgarh in Baluchistan have already yielded evidence pertaining to the domestication of zebu cattle, possibly as early as 7000 BCE (Meadow 1993: 295-320). Some scholars also argue for the indigenous domestication of *Bos indicus* in Gujarat, in the Ganges region, Uttar Pradesh and within the peninsular India. However, the nature of that transformation has remained unclear so far, as there has been little problem-oriented archaeological investigation of that phenomenon. The depiction of humpless taurine cattle on the Indus seals indicates their presence in the Indian subcontinent around at least 2500 BCE. In addition, there is evidence in the form of depictions of zebu cattle in the primitive art and in some of the faunal assemblages of the Bronze Age sites in Mesopotamia. That provides evidence of the spread of zebu westwards to the Near East and the spread of taurine cattle eastwards to the Indus Valley, and supports the introgression between taurine and zebu cattle by the third

millennium BCE, as is also indicated by the genetic data. That would have continued in varying degrees ever since (Kumar et al. 2003: 49).

The origin of African cattle is more problematic, and tracing their story has not been easy. Prehistoric artistic representations in Africa suggest that the first domestic cattle of Africa were *Bos Taurus*. The *Bos indicus* that now predominate in the continent entered Africa later. The genetic evidence also shows that the earlier domesticates were taurine, and the zebu animals came later (Bradley et al. 1996: 5134). It is believed that the African cattle descended from taurine cattle, which were brought to North Africa from the Fertile Crescent. In addition, possibility of the third domestication event from wild North African aurochs populations has also been suggested. Whatever was the case, genetic studies of different African cattle breeds have suggested that taurine cattle spread west and south from North Africa. Later, both, the European taurine cattle and the Asian zebu cattle were brought to the African continent, where they interbred with the African breeds. The climate warming and increase in aridity might have provided an impetus for the directional expansion of *Bos indicus* westwards into Africa from its initial centre of domestication (Bradley and Magee 2006: 326).

Based on the geography and breed, the broad variation in today's worldwide cattle population can be most conveniently classified. Of the approximately 800 breeds of cattle in the world, one quarter are found in Asia, and a large number of those can generally be assigned to different breed groups. The most well known zebu breed in the Indian subcontinent are the Haryana (predominant in north India), Kankraj and Gir (both in the western region of India), Ongole (in southern India), and Sahiwal and Red Sindhi (both in Pakistan) (Bradley and Cunningham 1999: 19-21). These native breeds are of multipurpose use with unique genetic characteristics and these are often well adapted to home tract conditions, climate, diseases and nutritional environment. These breeds are the result of intense artificial selection for economically important traits.

Water buffalo (*Bubalus bubalis*)

Based on the morphological, behavioural, and geographical criteria, the water buffalo have historically been divided in two types: the swamp buffalo and the river buffalo. (Fig. 3.7) These are sometimes also referred to as the different subspecies as *Bubalus bubalis* carabensis and *Bubalus bubalis* respectively. These two types also differ in chromosome numbers. Genetic estimates of the time of divergence of the river and swamp buffaloes vary widely; nevertheless, all these estimates predate the domestication of buffalo. While swamp buffaloes are found throughout Southeast Asia and China, river buffaloes are mainly found in the Indian subcontinent and westwards through the western Asia and Mediterranean countries (Groeneveld et al. 2010: 11-12). The geographical range of swamp and river buffaloes overlaps in eastern India and Bangladesh. Buffalo found in Sri Lanka morphologically resemble the swamp buffalo. However, genetic data identify these as the river buffalo. Recently, the buffaloes have also been introduced in Africa, South America and Australia. In addition to providing milk, buffaloes are important in the agricultural economy. In addition, these also provide meat, hide, horn, and so on. As the name implies, the water buffaloes, whether of the river or the swamp type, have an inherent predilection for water. These animals love wallowing in water or mud pools. While the river buffaloes show preference for clean, running water, swamp buffaloes like to wallow in muddy water, swamps and stagnant pools. These animals are also closely associated with the smallholders in the rice fields.

Fig. 3.7 Water buffalo

There are three wild species of the buffalo: (1) the tamarao (*Bubalus mindorensis*) of Mindoro in the Philippines, (2) the small anoa (*Bubalus depressicornis*) of Indonesia, and (3) the Indian wild buffalo (*Bubalus arnee*) (Cockrill 1984: 55). The Indian wild buffalo is considered the progenitor of all breeds of domestic buffaloes. The Indian wild buffalo was once common across the Indian subcontinent. However, their number has decreased rapidly in recent years because of the environmental processes and hybridisation with the domestic populations. This wild species is now confined in a few areas of India, Nepal, Bhutan and Thailand. While, the initial genetic studies suggested a single domestication event for the both, swamp and river buffaloes, the recent genetic studies indicated separate domestications of river and swamp buffaloes in the Indus Valley and Yangtze Valley civilizations in the second millennium BCE (Kumar et al. 2007: 227-232).

Archaeological evidence suggests that water buffaloes were first domesticated as the work animal during the Indus civilisation some time prior to 2500 BCE. A number of Indus seals depict

representations of buffaloes, mostly male buffaloes. Those seals depict the animal in activities, namely walking, rearing, feeding, and fighting, being watered and fed and so on. In addition, buffaloes have been depicted on the potteries. (Fig. 3.8) However, there are few archaeological evidences for the history of their domestication. Such evidences are mainly restricted to their depiction on the seals and bones. Sporadic remains of wild buffalo have been recovered from Mehrgarh 'IA' deposits, in addition to a complete horn core from 'Period III' that can be dated to 4800-3300 BCE (Meadow 1989b: 143-179). Furthermore, the Santhali microlithic site in Gujarat revealed clusters of the both, skulls and appendicular bones of at least eight wild water buffaloes. The horn core recovered from the site of Mehrgarh has basal dimensions that are intermediate between two of the wild specimens from the site of Santhali (Meadow and Patel 2002: 399). The 'mature-Indus' site of Dholavira (2500 BCE) revealed evidence of the both, wild and domestic water buffaloes. Evaluation of measurements revealed that Dholavira buffaloes were much smaller to those from Santhali and Mehrgarh (Patel 1997: 110-111). That shows a significant size diminution in buffaloes before the Indus phase. The skeletons of Santhali water buffaloes provide an important baseline to identify and evaluate the degree of size diminution that accompanied domestication (Meadow and Patel 2002: 399).

Fig. 3.8 Water buffalo horn depicted on pottery at Kot Diji (Courtesy: J. M. Kenoyer)

Seals of the Mesopotamian civilisation also depict water buffaloes.

Male buffaloes frequently appear on the cylinder seals from the Akkadian period of ancient Mesopotamia, which may indicate the presence of domestic buffaloes in Mesopotamia around 23502150 BCE. The domestic buffaloes were introduced to Mesopotamia from the Indian subcontinent twice: first, during the late third millennium BCE and secondly, during the Sasanian period (CE 224-651) (Boehmer 1974: 1-19). An earlier evidence of as early as 7000 years ago on the domestication of buffaloes in the Yangtze Valley of China has been suggested, but the recent genetic studies based on mtDNA sequences indicate a date of 2000 BCE (Yang et al. 2008: 2778-2785). The buffaloes in China seem to have played major role in ritual ceremonies. The heads of buffaloes are represented on the handles of cult vessels and cultic pillars of the Shang epoch. The buffaloes are absent in the other parts of the ancient world, and their diffusion to those places seems to be a late phenomenon (Cockrill 1984: 52-63).

In recent years, the buffaloes have been introduced not only in Asia, but also in Europe, South America and other continents, where their production has developed well. At present, there are a few well-defined breeds of the standard qualities and specific physical characteristics in India. Out of all breeds, six breeds—Murrah, Nili-Ravi, Jaffarbadi, Bhadwari, Surati and Mehasana—are the high quality milch breeds. These all come from the north and west regions, comprising the states of Punjab, Rajasthan and Gujarat.

Mithan (*Bos frontalis*)

Mithan (*Bos frontalis*), also known as ‘gayal’, is a domesticated bovine of the hill region in eastern India. Though the designation *Bos frontalis* is most commonly used for mithan, the animal is also sometimes called *Bibos frontalis* or *Bos gaurus frontalis*. The species is found in the north-south hills and low mountains that separate India and Bangladesh from Myanmar, and the east-west highlands that lie below the high Himalay of the easternmost India. A few of this animal have also been reported from the hills of northern Myanmar. Wild gaur (*Bos gaurus*) was most probably the ancestor of mithan. Not only is the mithan’s distribution range well within that of the gaur, but it also resembles the gaur in many ways. By using the traditions and present-day practices of the native people, Simoons attempted to reconstruct the domestication process of mithan. He says that the mithan is generally attracted to humans by its craving for salt; and it was probably for that reason that it developed permanent association with the humans. There is no definite historical record of this animal before the arrival of Europeans in India. In addition, the early archaeology of places where mithan is currently found is largely unknown. At present, mithan is used neither for traction nor for milk. Its primary traditional use is for sacrifice, when the people eat its flesh. According to Simmons, mithans are sacrificed on all good and bad occasions: may it be a weddings or burial (Simoons 1984: 34-39). The mithan horns are used as the drinking vessels, especially for rice beer, but neither its bones nor hide are used for economic purpose (Clutton-Brock 1987: 138).

Yak (*Bos grunniens*)

The yak or grunting ox (due to the grunting noises that it makes) is a type of long-haired and bushy-tailed cattle, which lives in the Qinghai-Tibetan plateau of western China, Mongolia, the Russian steppes and in some Himalayan countries. (Fig. 3.9) These areas have harsh climate and high elevations. Yak can withstand extremely harsh conditions and remain productive. These animals look clumsy, because of their long hair and wool and an enormous tail with very long hair. However, these animals are exceedingly agile and can travel long distances along the narrowest mountain trails. The yak's temperament and the special shape of its hoofs keep it going even in treacherous terrain. That makes yak an excellent pack animal, which can carry loads up to 150 kg at as high altitudes as 6000 m. It also provides milked and meat. Additionally, the grazing habits of this animal allow use of diverse vegetation, from shrubs to the shortest grasses.

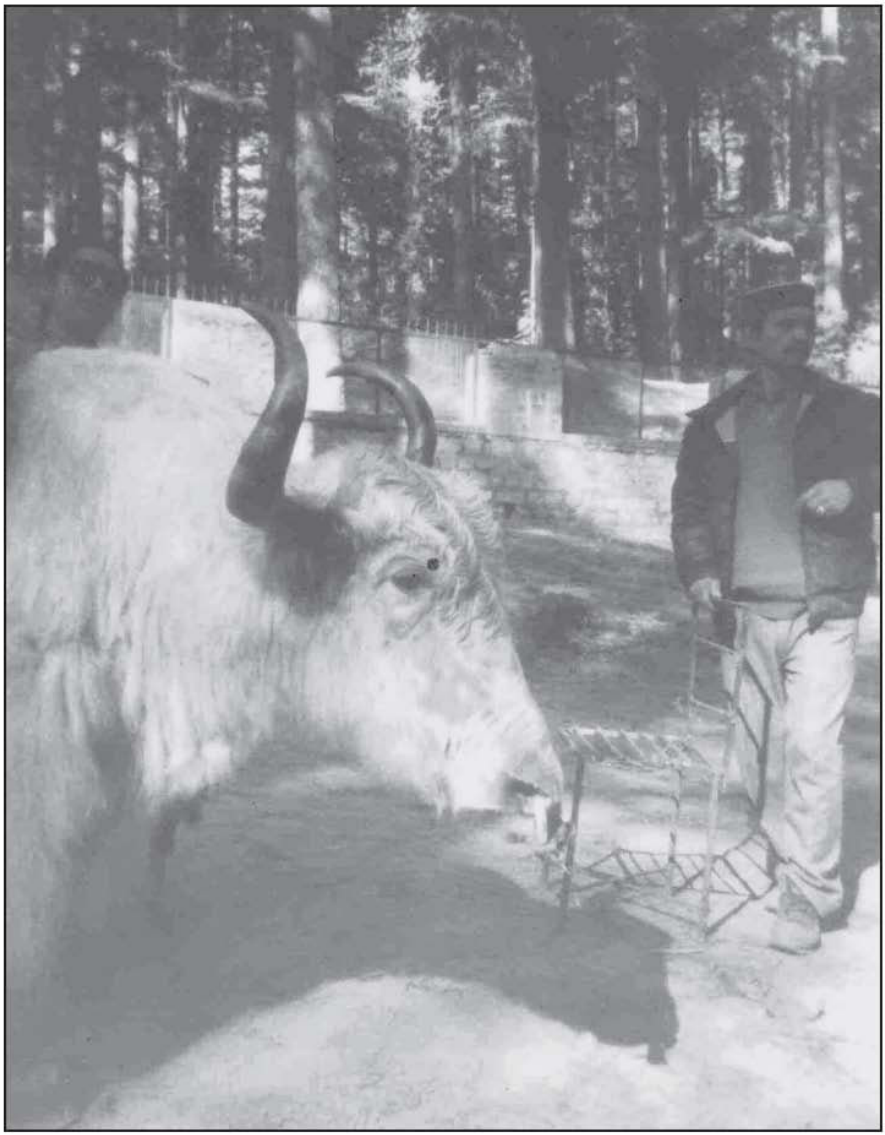

Fig. 3.9 Yak in Himachal Pradesh

The domestic yak is descended from the wild yak. The domestic yak differs little from its wild counterpart, except that it is smaller, has shorter and thinner hair, and may be variable in colour (Clutton-Brock 1987: 138-139). Genetic studies of yak revealed two maternal lineages, contributing to the ancestral yak gene pool, but haplotypes of both groups were found in a single yak population, suggesting a single domestication event in China or Tibet around 10,000 years ago (Groeneveld et al. 2010: 11, 22). These findings are also supported by the archaeological findings, besides the majority of wild yaks are found today within this region. More recently, an intensive genetic study of

domestic yaks from all the yak-keeping countries (China, Bhutan, Nepal, India, Pakistan, Kyrgyzstan, Mongolia and Russia) revealed a third, less frequent, lineage (Qi et al. 2008: 427-472). That genetic study also indicated that the domestication event in China or Tibet was followed by two migratory events. The first migration took place westwards, passing through the Himalayan and Kunlun mountain ranges. The second migration happened through the south Gobi and the Gobi Altai mountains to Mongolia and Siberia.

Pig (*Sus domesticus*)

Few animals are as misunderstood as the pig. Most people envisage pigs as a metaphor for dirt, dung, mess and mud. In addition, pigs are generally considered lazy and stupid animals. However, many scientists think pigs are the fourth most intelligent animals after chimpanzees, dolphins and elephants. Pigs are mainly raised for meat, and these are usually dismissed from the 'Secondary Products Revolution' as these provide neither traction nor milk nor wool. This is not true: pigs are more than food and have many non-meat uses. Many pig parts—skin, bones, bristles, and so on—are used for making various products. However, pigs are perhaps the most important as a waste disposal unit. As omnivorous animals, pigs consume both human excreta, and the kitchen refuse that the human digestive tract cannot handle at all. While that makes pigs seem 'dirty', these can be a help in keeping a village clean and in suppressing diseases (Nelson 1998: vii).

Domestic pigs are all descended from one common species: the wild boar (*Sus scrofa*). This is still a relatively common animal found in many countries throughout Europe, Asia and North Africa. The wide geographical distribution of wild boar (wider than that of any other ancestor of a domestic animal) has presented a special challenge to those interested in identifying the initial sites of pig domestication. Wild boars were an important hunted resource for many millennia before the process of domestication significantly altered their relationship with the humans. The pathway to pig domestication was likely to be quite different from that of other domestic animals. The domestication of pig was probably preceded by a getting-to-know-you period in which bolder and less wary boars were drawn to the human settlements (Zeder 2007: v). As being the curious scavengers, wild boars were perhaps attracted to the human living areas to scavenge on human refuse, and the people, in turn, began to confine them and exert increasing control over their breeding (Dawson 1998: 7).

Earlier genetic studies identified a significant split between the domestic pigs derived from Europe and the ones derived from Asia. Those studies pointed out that the European and Chinese pigs were domesticated independently. However, the recent studies have suggested multiple centres of domestication (Larson et al. 2007: 30-41). The mtDNA data pointed to the separate domestication events in the central Europe, Italy, India, Southeast Asia and southeastern

Asian islands. On the genetic evidence recovered from Indian subcontinent, it is noted that ‘Several wild boars from Kashmir and Bengal in the Indian subcontinent form their own monophyletic clade. A single domestic pig, also from Bengal, shares the identical haplotype with one of the wild boar, thus implying that wild boar from India have either been independently domesticated, or have contributed maternal DNA to domesticates brought in from other places’ (Larson et al. 2007: 36).

More recently, it was recognised that the genetic evidence from India clearly suggest an indigenous process of pig domestication, for the modern Indian domestic pigs are derived from local wild boar, as no mixing of indigenous wild populations with those of east Asian or near-eastern resources can be seen in the genetic data (Larson et al. 2010: 7686-7691). However, those genetic results are yet to be corroborated by the archaeological evidence. Archaeologically, very little is known about the history of domestic pigs in the Indian subcontinent. While the occurrence of Sus bones is a widespread phenomenon in the archaeological sites of India and Pakistan, those bones form a minor component of the archaeological assemblage. Additionally detailed morphometric criteria for separating wild and domestic pigs in this region are not well established. Future systematic work may provide archaeological evidence of pig domestication in this part of the world.

Genetic evidence also revealed that the neolithic farmers from the Near East brought domestic pigs with them as they spread across Europe. Pigs of Near East origin were present in the central France 6000 years ago (Larson et al. 2007). However, European wild boars were also being domesticated at the same time, and later on those completely replaced the pigs of Near East origin. That European pig domestication may not have been a true domestication event, but rather a direct consequence of the introduction of near eastern domestic pigs that the early farmers brought to Europe. Therefore, the process of pig domestication in Europe could have been fundamentally different from that in the Near East. Both genetic and archaeological evidence have also demonstrated that the pigs were domesticated in the East Asia. That process took place at least once in the Yellow River drainage basin, and that may have taken place independently in the downstream Yangtze River (China) (Larson et al. 2010: 7690) However, unlike Europe, modern Chinese pigs are the direct descendants of the first domestic pigs in this region.

Over the past decade, each new published genetic data for pigs has increased the number of new centres of pig domestication. These results imply that perhaps the question should no longer be ‘where did

pig domestication occur?' but rather, 'where domestication of pig did not take place?' (Larson et al. 2007: 40).

Establishing the temporal context of pig domestication is not as easy as it is for some other species. There are many types of pig-human relationships and correctly identifying those in an archaeological context is not easy (Fig. 3.10). In addition, the widespread distribution of wild boar leads to a variety of suggestions pertaining to the pig domestication. The beginning of pig management and domestication most probably began sometime between 10,000 to 8,000 years ago. The site of Cayonu Tepesi, located in southeastern Turkey, is perhaps the most important and earliest one that has provided valuable evidence of pig domestication (Ervynck et al. 2002: 47-73). That site has a unique 2,000-year stratigraphic sequence (from the pre-pottery to the pottery neolithic levels) that allows one to create a temporal framework, within which the process of domestication can be studied in detail. Remarkably, evidence from that site suggests that probably pigs were not driven by direct human intervention. Hallan cemi Tepesi, another Turkish site, has also given evidence of a shift from a completely wild behaviour of wild boars to a way of living closer to the humans (Rosenberg and Redding 1998: 55-64).

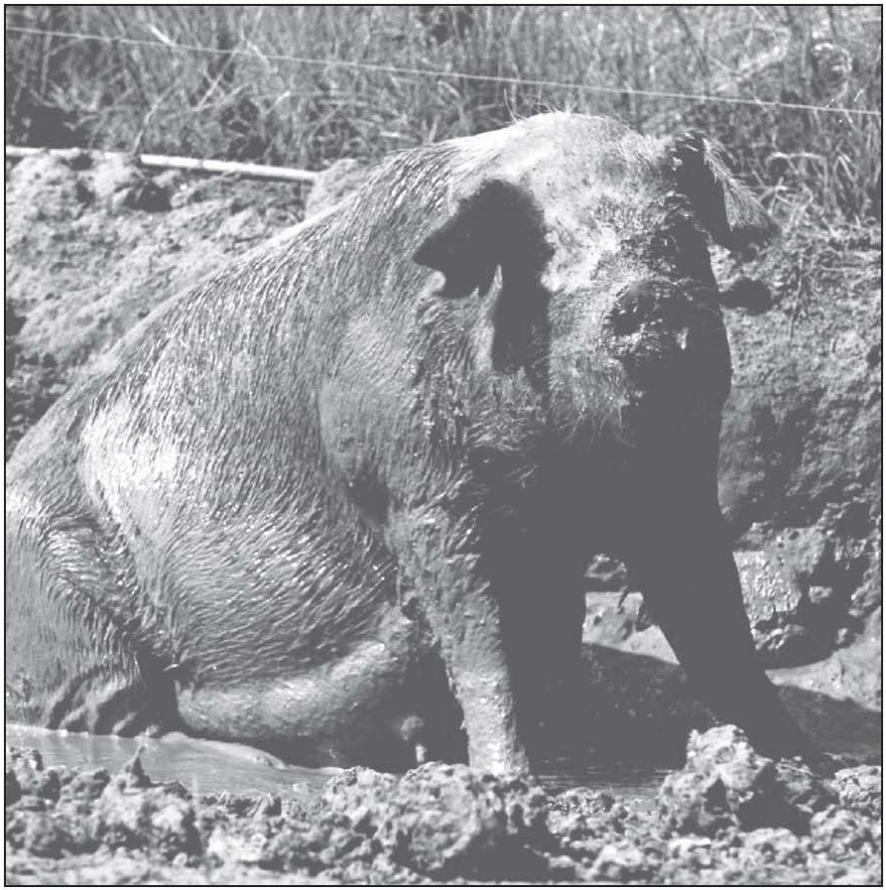

Fig. 3.10 Domestic pig

Therefore, tracing the history of today's pig breeds is somewhat difficult. The pigs have largely remained a household animal until recently. Additionally, people who tend pigs are generally given a low status in many cultures, and the careful written records are not kept about them or their occupation. Since, pigs are kept only for profit, not for social status (like other animals), many new techniques, including scientific breeding have been adopted and great strides have been made in the last 30 years.

Horse (*Equus caballus*)

The domestication of horse was certainly of momentous significance in the history of human-animal interactions. (Fig. 3.11) Horses have been used in almost all walks of human life: they have been harnessed for almost all purposes, like food, agriculture, pastoral activities, traction, transport, hunting, and especially in warfare. However, the most important improvement that the horse brought about in some ancient societies was in transportation. It allowed people to move faster from one place to another farther away with the heavier loads. In addition, the swiftness and fearlessness of a horse also made it the best mount not only in warfare, but also in hunting. That resulted in raising the status of horse among the other domesticated animals. At the same time, it also raised the status of a person owning it. Therefore, the presence of horses has been creating social and economic distinctions among people since the ancient times.

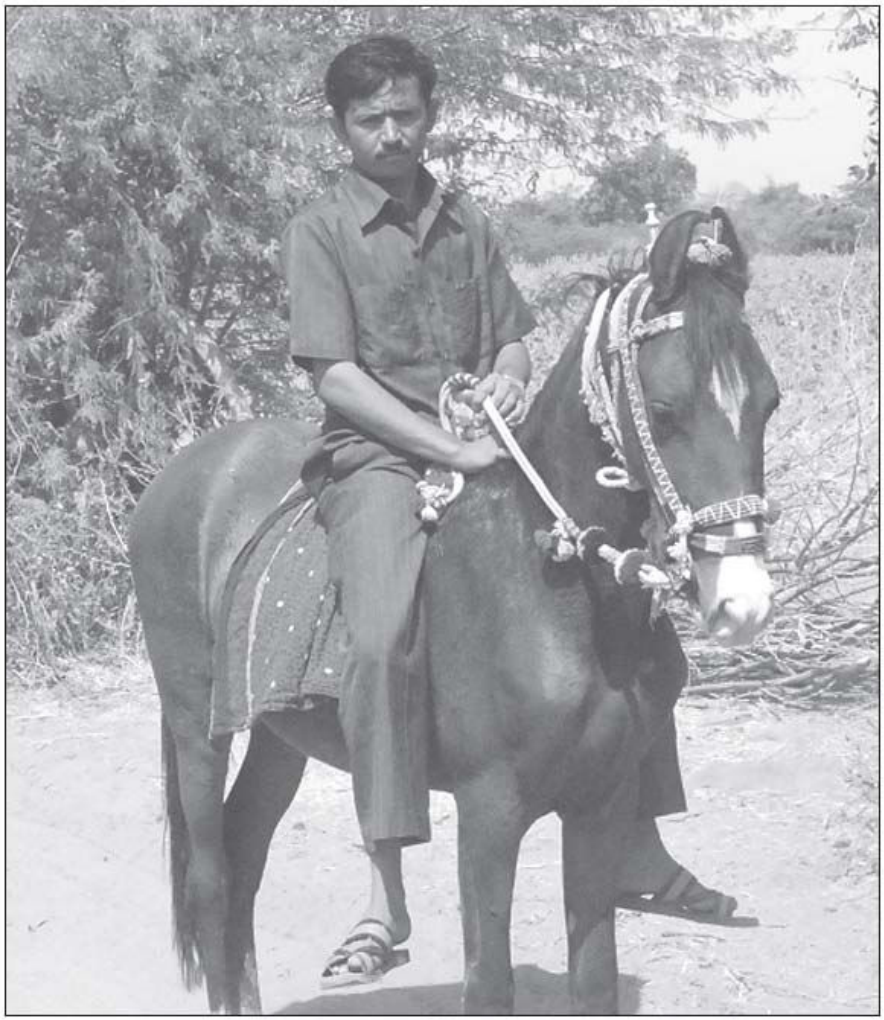

Fig. 3.11 Domestic horses

The question—when, where and why the horses were first domesticated—is still the topic of hot debate. The domestication of horse essentially differs from other animals: while the domestication of earlier animals (dog, sheep, goat, pig, and cattle) were without precedent and presumably for the purpose of securing live food resources, the domestication of horse happened when man was fully aware of further possible uses (milk, wool and traction) of this domesticate (Bökönyi 1984: 166). Therefore, Bökönyi argues that it is conceivable that in addition to meat, another motive to domesticate the horse was to utilise it as a working animal. Clutton-Brock suggests that horses were probably husbanded as food animals first, as their chopped bones are found in the archaeological sites along with the other remains of kitchen debris (Clutton-Brock 1987: 80). However,

people soon realised that the horses could be loaded with goods, ridden on and trained to pull carts. On the other hand, Levine contends that the horse was not domesticated first for its flesh, as the population structure of horse bones recovered from the same archaeological sites is very much unlike those resulting from herding, but fits very well to those resulting from hunting activities (Levine 2003: 4). He proposes that horse domestication first developed out of horse taming, and that probably first arose as a by-product of horse hunting for meat. On the origins of horse domestication, he says:

> Orphaned foals, captured between the ages of perhaps two months and one year, or possible somewhat later, would sometimes have been adopted and raised as pets. Eventually, and perhaps repeatedly, the discovery was made that these pets could be put to work. This knowledge could have been acquired and lost many times from the Pleistocene onwards. But it was, apparently, only during the Holocene – possibly between the Neolithic and the Early Bronze Age – that it began to influence human social developments. Apparently, before this time, the social and economic context necessary for the development of horse husbandry did not exist.
>
> *Levine 2003: 4-5.*

The debate whether horses were tamed or truly domesticated has raised many questions of what truly constitutes a 'domestic' horse population and how it can be detected in the archaeological record. In addition, despite over a century of morphometrics on equid skeletons, it is still extremely difficult to distinguish remains of the domestic horse from those of wild ones (Olsen 2006: 256). As we shall see below, there is even considerable variation among caballine equids during the Pleistocene period. Therefore, scholars have used a wide range of secondary data in documenting horse domestication.

Another problem that challenges scholars seeking to document the domestication of horse is the determination of the wild progenitor of domestic horse. There were many types of caballine equids of large and small forms present in the Pleistocene period. It led to believe that different wild equids gave rise to different breeds of domestic horse. However, of all the different varieties of horses in the Pleistocene, only one relatively small species of wild horse survived into the Holocene and gave rise to the domestic horse. That species is generally known as the tarpan (*Equus ferus*) (Frosten 1988: 161-176). Most of the present researchers seem to have been in agreement with that idea and they search for a single species with a broad geographical distribution as the wild progenitor of domestic horse. Nevertheless,

scholars also believe that domestication process occurred more than once within that species' range. The DNA evidence also reveals that horse was domesticated independently several times (Jansen et al. 2002: 10905-10910). Of late, the tarpan (wild European horse) and the Prezwalski's horse (wild Asiatic horse) are generally used for comparison with the possible early domestic species. Of those two species, Prezwalski's horse is much better known. However, despite the similarity of mtDNA sequences, other lines of evidence suggest that Prezwalski's horse may not be the direct progenitor of domestic horse. The difference in the number of chromosomes between Prezwalski's horse and domestic horse has been interpreted as having an ancient origin (Jansen et al. 2002: 1090510910. According to Olsen, the tarpan, as problematic as it is, is still the best candidate for the ancestor of the domestic horse (Olsen 2006: 246).

Wild horses make their appearance in the upper Palaeolithic art around 32,000 years ago. Some of the most splendid depictions of horses have been found in the upper Palaeolithic of southwestern France at such sites as Grottes Chauvet, Lascaux, Pech-Merle, and many others (Levine 2003: 4). Those horses were probably hunted for meat and contributed significantly to the diet of people. The range of wild horses reduced greatly by the end of the Ice Age due to both, the human predation and the spread of forests. Accordingly, 'It could well be that horse was a species of equid that evolved during the Pleistocene and at the end of that period was doomed to extinction by changing climatic and ecological conditions. By chance, a man saved it and reintroduced it into its former habitat under his protection and as a tamed animal' (Clutton-Brock 1987: 81).

The earliest evidence of domestic horse comes from the site Dereivka, a Copper Age settlement in Ukraine, dating to between 4470 to 3530 BCE (Rassamakin 1999: 162-163). However, recent radiocarbon dates suggest that the so-called cult stallions of Dereivka were an Iron Age intrusion from the first millennium BCE (Anthony and Brown 2000: 75-86). That evidence has suddenly reopened a debate on both, the timing and location of horse domestication. More recently, a prime candidate for horse domestication has emerged in the Eurasian steppe, specifically the Botai culture, northern Kazakhstan. That culture can be dated to the mid-fourth millennium BCE. The case for horse herding within the Botai culture includes horse-centred economy, establishment of large and permanent settlements with possible corrals, presence of horse manure in house fills, horse or dog ritual associations, horse slaughter patterns, abundance of thong-making tools and changes in the lithic sources and manufacturing practices (Olsen 2006: 265). Lately, Outram et al. have not only

provided evidence related to bridles use but also demonstrated the use of mare's milk processing at those sites (Outram et al. 2009: 1332-1335). All these evidence provide a compelling argument for the existence of domestic horse in the Botai sites. However, that does not prove that the Botai were the first to domesticate horses. On the other hand, there are indications that either people from Urals moved into this region in the Copper Age, bringing domestic horses with them, or that the indigenous neolithic people adopted horse domestication from their neighbours to the west (Olsen 2006: 265). Genetic studies also advocate that horse domestication occurred more than once and perhaps many times along the Eurasian steppe

After being domesticated, horses are believed to spread quickly in all directions. Horses in larger numbers appeared in the central, southeastern and western parts of Europe by the beginning of Bronze Age that can be dated to the third and second millennium BCE (Bökönyi 1984: 167). Horses also reached Mesopotamia and other regions of the Near East, during the second half of third millennium BCE. In India, horse bones have been reported from many Indus sites that can be dated to 2500 BCE. While the presence of horse bones in the Indus context is a topic of great debate, towards the later phase of Indus culture, the horse not only made its presence felt, but also become widespread. The subject has been dealt with in detail in Chapter 6.

The long partnership forged between humans and horses is evident in the myriad of phenotypes now observable in horse breeds. Many of these breeds are still in the formative stages. Most of the more than 395 horse breeds in existence today have a recorded history of less than 20-30 generations. Bökönyi (1984: 170) states that conscious horse breeding resulting in higher productivity in the form of large sizes, better proportions, greater muscle power and higher speeds first occurred in the Middle East. While biological evidence of the existence of different breeds goes back in the above region as far as the beginning of first millennium BCE, pictorial evidence can be found a couple of centuries earlier.

Ass (*Equus asinus*)

Colloquially the ass is known as ‘donkey’ (originally ‘dunkin’) with reference to the commonly greyish brown colouration of the coat. While domesticated horses brought about a significant change in human societies, domestication of the ass was also an important step. Their role was especially important in the southern and more arid regions of Eurasia and northern Africa, as the ecological requirements of those animals were different from those of horses. The ass is a sturdy animal and can easily withstand repeated heat stress. It can tolerate heavy loss of body water by controlling its water loss through skin. The nutritional requirements of the asses are also very modest. They can feed on coarse pasture, thistles and thorn bush. Being tough animals adapted to the desert, plus endowed with the ability to carry heavy loads through arid lands, donkeys might have enabled pastoralists of those regions to move farther more frequently and to transport their households with their herds (Rossel et al. 2008: 3715). (Fig. 3.12)

Fig. 3.12 Domestic ass

In that way, the donkeys might have offered a more efficient transport system than horses in those arid lands could. Another important

outcome of the domestication of donkeys was the possibilities of creating hybrids with horse (mules, hinnies) (Vila et al. 2006: 343). Clutton-Brock (1987: 95) says, '…it is perhaps as the father of the mule that the donkey has made its greatest contribution to human economies.' The mule, as a beast of burden, has more stamina and endurance, and it can carry heavier loads in comparison to both the horse and ass.

Preliminary genetic survey based on mtDNA sequences indicates that the domestic ass and the African wild ass (*Equus africanus*) belong to the same group. Recent phylogenetic analysis of the domestic ass and all of the living asses and half-asses also clearly shows that the domestic ass was originated from African wild asses (Vila et al. 2006: 342-353). Genetic studies also suggest that not one, but two clades of domestic asses were domesticated, one of which groups with the Somali wild ass and the other with Nubian wild ass. The Nubian wild ass is now believed to be extinct, but it was previously distributed over the mountainous semi-deserts of Nubia and the eastern Sudan from the Nile to the shores of Red Sea. The Somali wild ass (*Equus africanus somaliensis*) still survives. This ass is larger than the Nubian subspecies. At present, this species is found only in the northern Somalia and in the Danakil region of Ethiopia (Clutton-Brock 1987: 93). In addition to the domestication of ass from the African wild ass, there is also a suggestion that the Asiatic half-ass, commonly known as onager (*Equus hemionus*), was also either domesticated in the western Asia or was used to hybridise with the domestic ass there (Clutton-Brock 1987: 93-96). However, the genetic data of Vila et el. do not support this, but they do not rule out the possibility of hybridisation in the ancient world between the Asiatic half-asses and domestic asses. They say, 'the offspring of such a pairing would be sterile and therefore a dead genetic end' (Vila et el. 2006: 342-353).

Based on the archaeological evidence, three different regions (the Near East, the Arabian Peninsula and northeast Africa) were suggested as possible centres for the domestication of donkey in the beginning. However, recent archaeological evidence suggested that northeast Africa is the most probable place for the origin of domestic ass. More recently, genetic evidence also demonstrates that the ass was likely to be domesticated from two divergent wild ass lineages in northeast Africa, one of that was around the northeast region of Sudan around the Red Sea and the second was further southeast along the coast of the Red Sea or Gulf of Aden (Vila et al. 2006: 350).

The best evidence of the earliest use of the domestic ass came from Egypt. The earliest skeletal remains, thought to be of the domestic ass,

were identified in the Egyptian prehistoric settlements of El-Omari (ca. 4600-4400 BCE), Maadi (first half of the fourth millennium BCE) and Hierakonpolis (ca. 3600 BCE) (Rossel et al. 2008: 3716). The presence of bones of both wild and domestic asses in the Dynastic Egyptian sites indicate that Egyptian nobility kept hunting African wild asses long after those were domesticated. A rock engraving in the western desert of Egypt shows an ass with a burden on its back attached by girths, and another palette from Giza depicts domestic asses in a line between rows of domestic sheep and cattle. From the middle of the third millennium BCE, there is a regular depiction of the asses in the Egyptian paintings. An inscription on a tomb (dated to the middle of the third millennium BCE) records 760 asses among his master's herds of over 5000 animals (Epstein 1984: 176).

The precise way that led to the domestication of asses is not known. According to Vila et el., two main events preceded the domestication of donkeys and those events may have influenced the domestication process. They write:

> First was the desertification of the Sahara after the end of the last glacial maximum (ca. 9000-12,000 BP). The increased aridity would have necessitated more frequent relocations, greater travelling distances between camps, and permanent oases for early pastoralists. Domestication of donkey, therefore, may represent the response of pastoralists and other societies in northeastern Africa to these changes. Second was the appearance of the first organised nation in that nation, the Pharaonic kingdom, which inevitably brought new patterns of life and movement. Better communication was necessary to enforce the power of the Pharaoh across the country and to promote economic growth through trade.
>
> *Vila et al. 2006: 350.*

The donkey, although like a horse in many respects, and often a better choice for hard work, is considered an extremely ugly, violent and wanton animal. Their use has been looked upon as synonymous with backwardness, underdevelopment and low socioeconomic status. The donkey as a symbol of foolishness and illicit sexual activity is an old tradition, perhaps as old as its introduction into the Indian subcontinent from North Africa. Another equid species introduced in the Indian subcontinent, the horse was accorded a high status and was associated with nobility since the early historical period. The reason for such poor treatment given to the ass is not known from any of the bio-historical sources. However, from the archaeological evidence, it is clear that the domestic ass was commonly used during the early historical period all over India. From very early times, this extremely

useful and hardworking animal was connected with ugliness, vulgarity and illicit sexual behaviour. It shows that the attitude of treating an animal or assigning it a specific social ranking like the human hierarchical positions is a highly complex phenomenon, and not necessarily dependent on economic value of the animal.

Camels

Camels have an ancestry dating from the late Eocene in North America. The fossil records show that the early evolution of camel family took place entirely in North America, perhaps some 40 million years ago. During one of the Ice Ages, a solid bridge between Alaska and Siberia closed the Bering Straits and enabled the early camels to migrate into Eurasia. Those camels became the founders of the old world camels: two-humped and the one-humped ones (Mason 1984: 107). Some migrated from North America to South America and became the founders of the South American camelids, also known as the new world camels: llama and vicuna. Meanwhile the camelidae became extinct in the North America, possibly due to over hunting.

Old World Camels

At present, there are two species of domestic camel: the Dromedary camel (*Camelus dromedaries*) and the Bactrian camel (*Camelus bactrianus*). These are also known as one-humped and two-humped camels, respectively (Fig. 3.13 and Fig. 3.14). One-humped camels are uniquely adapted to hot and dry climates. These are found in about 35 countries from the east of India to the west of Senegal, and from south of Kenya to the north of Turkey. Two-humped camels are found in the desert steppes of Central Asian countries, in Turkmenistan, Kazakhstan, northern Pakistan and India (overlapping to varying degrees with one-humped camel), and further eastward to southern Russia, and down to northwestern China and western Mongolia (Jianlin 2005: 187). The camels are not only put to use as pack animals for their exceptional powers of endurance in harsh environments, but these also provide food, wool, milk and dung that can be used as either fuel or manure. To a limited extent, these animals were also used in warfare in the past. Camel racing is a popular sport in the Arabian countries. About the economic productivity of camels, Kohler-Rollefson says:

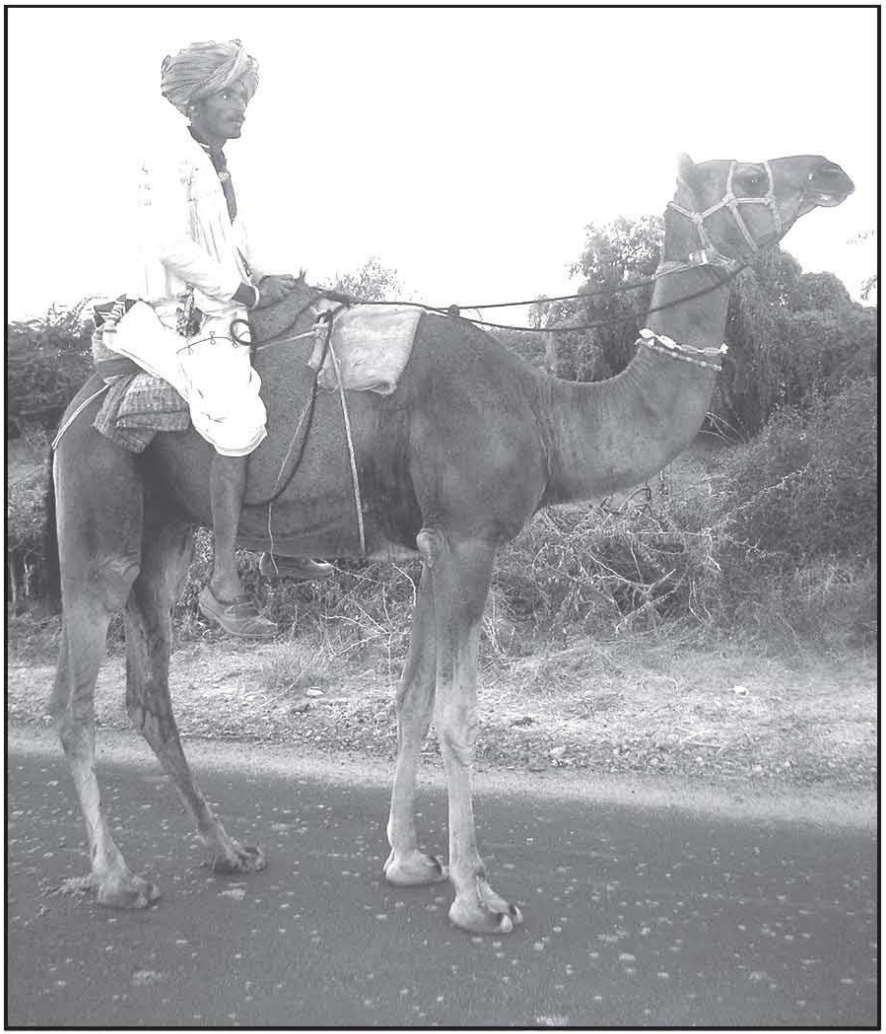

Fig. 3.13 One-humped camel

Fig. 3.14 Two-humped camel

> Camel can produce up to 10 kg of milk per day or 4000 litres per lactation period, even under traditional methods of pastoral management; their meat is tasty, with live weights of up to 600 kg and carcass weights of around 300 kg; they can be bled to provide 5 litres of blood per month; wool yields are 1-1.5 kg per camel per year; their dung is an excellent fuel and has fertilising effects; they can carry burdens of up to 200 kg at a pace of 2-3 km/hour; and as riding animals they can cover distances of 65-80 km per day over extended periods, or 112 km per day for two days, or 144 km in one day.
>
> *Kohler-Rollefson 1996: 286*

The history of domestication of old world camels is poorly known. As the modern South American camelids have no hump, it is generally asked whether the early camels that moved from North America to Asia had humps or not. According to Masson, 'It is still tempting to suggest that the double hump looks much more like a man-made trait than a natural adaptation to some specific environmental condition' (Masson 1984: 108). He proposes two possibilities: (1) The first camel in Asia and Africa was two-humped and the single humped one

developed because of its adaptation to hot and dry conditions of the Middle East and North Africa and, (2) the first camel might have had no hump, and from that, two types of humped camels might have developed independently.

However, recent genetic data suggests different ancestors and separate domestic events for the one-humped and two-humped camels (Groeneveld et al. 2010: 16). For the two-humped camel, that took place in Central Asia, perhaps as early as the third millennium BCE (Peters and von den Driesch 1997: 651-679). For the one-humped camel, that occurred towards the end of second millennium BCE in the southern Arabian Peninsula (Peters 1997: 559-565). From these areas of origins, the camels dispersed over all of northern Africa, parts of east Africa and Asia, as far east as India. Archaeologically, the earliest evidence for domestic camels comes from the site of Shar-i-Sokhta in Central Iran, where clay vessels containing camel dung and cloth woven from the combination of camel and sheep hair were recovered (Compagnoni and Tosi 1978: 91-103). That site can be dated to approximately 2600 BCE. The excavators of the site believe that the camels at that site were domesticated and they were more likely to be two-humped than the one-humped species.

New World Camels

Of the new world camelids, the llama (*Lama glama*) and the alpaca (*Lama pacos*) are the only large herd mammals that were domesticated in all of America. These animals are producers of both primary and secondary products, such as meat, hide, fibre and dung. In addition, the llama is also used as a beast of burden. Both species in the present and in the past have played important role in ritual ceremonies. Both those species were also frequently represented in the prehistoric pottery, rock art and figurines. The comprehensive survey that Gonalons and Yacobaccio did on those camelids, and the large literature available on sites from the northwest Argentina, Chile and Bolivia show that the domestication process of those animals was a widespread phenomenon (Yacobaccio 2006: 228-244). Their data suggest that people across central and south-central Andes were all embarking on a similar domestication process that eventually resulted in the domestication of the llama and alpaca, perhaps multiple times at multiple places. They also suggest that the domestication of llama happened sometimes between 4400 and 3000 BP (Gonalons and Yacobaccio 2006: 239). There is no general agreement on the timing of the domestication process of alpaca.

Elephants

At present, there are two species of living elephants: the African elephant (*Loxodonta africana*) and the Asian or Indian elephant (*Elephas maximus*). (Fig. 3.15 and Fig. 3.16) The African elephants not only have larger bodies than the Asian elephants, but also have larger ears and exceptionally long and heavy tusks. Both these elephants are highly intelligent and respond well to the human commands. These elephants are relics of a once much more diverse family that inhabited almost every part of the earth during the Pleistocene period. The association of hominids with elephants stretches back to the Middle Pleistocene. The interactions of humans with elephants may be defined into three categories: predation for food (presumably the earliest interaction for exploitation), killing for ivories alone (a trade that has been of greatest importance in human economy since the beginning of earliest civilisation), and taming of live elephants for a number of uses (Clutton-Brock 1987: 115). The live elephants have been tamed for use in warfare, in circuses and zoos, in ceremonies and as the beast of burden, among other purposes.

Fig. 3.15 African elephant

Fig. 3.16 Indian elephant (Courtesy: Ashwini Shitole)

The Indian elephants have probably been tamed since the time of Indus civilisation (2500 BCE). Many of the Indus steatite seals depict elephant sometimes with a cloth draped over its back, indicating its use for transport. Besides, a number of Indus faunal assemblages have revealed the skeletal fragments of elephants, and an ivory workshop has been identified at the Indus site of Lothal, located in Gujarat. However, how all that began is all conjecture. Once the taming of elephants started, a cultural relationship between humans and elephants grew and became an inseparable part of the local religion, mythology, war and even everyday life (Olivier 1984: 185-192). Among the ancient documents, the Hastishastra is a compendium of various texts, of which the Manasollas (an encyclopaedic work on elephants) has been ascribed to the western Chalukya king, Someshvardev, who ruled in CE 12th century. The Manasollas deals with the topics related to elephants, like the genealogical, physical, mental and intellectual characteristics, techniques of tracing and capturing from forests, nourishment for healthy growth and general upkeep, taming and training them for war and work, and diagnosis and treatment of their disease. That may affirm that the science of elephants was seriously studied in India and

it has a continuous oral and written tradition. African elephants, on the other hand, are much more difficult to train. Nevertheless, the Romans used them extensively both in warfare and circuses. These are not commonly tamed at present.

Despite a long history of elephant in the service of man, it is still a matter of dispute whether the Asian elephants can be considered a domestic animal or not. This is because the Asian elephant naturally breeds in the wild, and there has been practically no breeding under control. Elephants have also never been enfolded within human societies like other animals. According to Olivier, ‘In many respects the elephant is very unsuited to domestication, and this is largely responsible for the minimal effort at controlled breeding (Olivier 1984: 187). To be viable as a full domesticant, an animal must breed and reach full productivity quickly. Clutton-Brock prefers to term elephants as ‘exploited captives’ (Clutton-Brock 1987: 104)

Domestic Fowl and Other Birds

Many species of birds have been domesticated by the humans, but by far the most common is the domestic fowl (*Gallus gallus domesticus*). Domestic fowls or chickens raised for meat are called ‘broilers’, whereas the egg-laying ones are known as ‘layers’. The domestication of fowl is sometimes claimed to have had its roots in some kind of interdependence that developed between humans and these birds on the edge of settlements in the jungle. The wild jungle fowl is believed to have been attracted towards human settlements for food and gradually become attached to villages, when humans started feeding these birds regularly. It is also believed that chickens were first used for cock-fighting and other ceremonial purposes, and it was much later that these were utilised as a source of eggs and meat (Crawford 1984: 300). That development appears to have been followed in all early civilisations, which possessed chickens.

At present, there are four species of wild fowls: the red jungle fowl (*Gallus gallus*), the Cingalese jungle fowl (*Gallus lafayettei*), the grey jungle fowl (*Gallus sonneratti*) and the green jungle fowl (*Gallus varius*). Of these, the red jungle fowl has been divided into five subspecies. Those five are identified as (1) Cochin-Chinese, (2) Burmese, (3) Tonkinese, and (4) Indian. As in other livestock species, sequence variation in mtDNA has been used to study the domestication events and relationships in chickens. Earlier genetic studies suggested that domestic fowls descended only from red jungle fowl and the domestication event took place in Thailand and its adjacent areas. Subsequent studies, however, suggested multiple origins of domestic fowls in South Asia and Southeast Asia. In addition, genetic studies also revealed that along with the red jungle fowl, grey jungle fowl and Cingalese jungle fowl might also have contributed to the genetic makeup of present domestic fowls, although to a lesser extent (Nishibori et al. 2005: 365-375). All those evidence clearly show that the red jungle fowl is the ancestor species of most of the modern domestic fowls. At present, the red jungle fowl has its widest distribution in East Asia, Pakistan, India, China and the islands of Sumatra, Java, and Bali.

The conclusive archaeological evidence of the domestic fowl comes from the Indus civilisation (2500-1900 BCE) in the form of seals, figurines, and bones recovered from a number of Indus sites. Archaeological evidence from China indicates much earlier association

of man and fowl. A number of reports of chickens can be dated to about sixth millennium BCE (West and Zhou 1988: 515-533). However, there remains a serious concern over the reliability of identification criteria. Since their domestication, domestic fowls have been distributed throughout various countries. Chickens appear to have spread from India to the west during the second millennium BCE. A historical document from the time of Tuthmosis III in Egypt mentions about 'the bird which lays an egg every day' (Uerpmann 2008: 444). Early in the first millennium BCE, chickens spread from the eastern coasts of Mediterranean to the Aegean and as far west as southern Spain (Uerpmann 2008: 444). It appears in Central Europe soon after 500 BCE. Gradually chickens spread to other parts of the world. At present, there are a wide range of chicken breeds because of many years of adaptation and breeding. These include more or less unselected indigenous chickens and ecotypes from various regions of the world, standardised fancy breeds selected for morphological traits and maintained for leisure activities, and experimental and commercial lines (Groeneveld et al. 2010: 18).

Other domesticated birds include turkeys (*Meleagris galloparo*), ducks (*Anas platyrrhynchos*), geese (*Anser anser domesticus*), quails (*Coturnix coturnix* and *Colinus virginianus*), guinea fowls (*Numida meleagris*) and pigeons (*Columba livia*), and so on. While turkeys were probably already domesticated in Mexico in prehistoric times, these are relatively a recent addition to modern agriculture around 1000 years ago. The domestic turkey is descended from the North American wild turkey. Wild turkeys from North America were taken to Europe by the visiting explorers. More likely, their regular breeding and eventual domestication occurred in Europe rather than in North America, though the manner of its domestication is unclear.

It seems that the actual origin of modern breeds of ducks is lost in antiquity, but these have been one of the earliest domesticated birds. Ducks were kept by the ancient Egyptians several centuries before the Christian Era (Roots 2007: 4). All breeds of ducks are descended from the widely distributed wild dabbling duck known as mallard. These are now mainly used for meat production, although some of its breeds are prolific egg-laying animals.

Domestic geese are descended from the graylag goose. The goose domestication is believed to have occurred in either Greece or Egypt about 1500 BCE (Roots 2007: 18). These birds are not only kept as guard animals, but also used for food. However, goose production never reached a large-scale proportion, and today it takes only fourth place among the poultry birds after chicken, turkey and duck.

Quails and Guinea fowls are the two recently domesticated birds, which are raised commercially in large numbers. There are two types of domestic quails: Japanese quails and North American bobwhite quail. While the Japanese quail is mainly kept for egg production, the bobwhite quail is kept for meat production. Guinea fowls are widespread in the African countries and are kept for both meat and eggs. Nothing much is known about the history of domestication of these birds and some scholars do not even consider these birds as domesticated. Pigeons are descended from the rock dove (pale grey Eurasian pigeons). These birds were domesticated around CE 1500 mainly for meat, but are now kept for sport (racing and homing pigeons) or for pleasure (fancy breeds). Turkeys, geese, ducks and bobwhite quail are all considerably heavier than their ancestors were, reflecting the successful selection for meat production (Keeling 2002: 102).

Another example of a recent domestication of a bird is the ostrich. Its domestication for feathers and meat began in the 19th century in Africa. It is now kept in many parts of the world.

In addition to all these birds, a large number of birds, such as budgerigars (lovebirds), parrots, cockatiels, doves, macaws and canaries, among others are kept as pets, providing companionship and pleasure. Some of these birds have even been bred in captivity for many years. This is especially true for budgerigars and canaries. However, this seems to have just happened as people started keeping these birds for momentary reasons, and not with the aim of transforming these into something.

4.

The Early Hunter-Gatherers

UNTIL ABOUT 10,000 YEARS AGO, ALL HUMANS WERE THE HUNTER-gatherers. However, in order to understand the hunting-and-gathering way of life, it is essential to reflect upon the history of what the 'hunter-gatherer was thought to be'. We address this point for the reason that it provides a window into the larger issues that is addressed in this book.

Earlier, the anthropological view on the hunter-gatherer subsistence rested on two probabilities. First, that those people primarily depended on the hunting of game animals and secondly, that their life was seen as a precarious and arduous struggle for existence (Lee 1968: 30). Studies related to hunter-gatherer subsistence practices, settlement patterns and society were rarely addressed by the anthropologists and archaeologists. Thus, the concept of 'hunter-gatherer primitives' remained ambiguous until about the mid-1960s, when the Wenner-Gren symposium on the concept of 'Man as the Hunter' was held at the Centre for Continuing Education at the University of Chicago in April 6-9, 1966 that brought those issues into light. The proceedings of that symposium were published as *Man the Hunter*, which very soon became a landmark among such studies. The contributors of that volume projected 'hunter-gatherer society' as having an egalitarian socio-economic base, high mobility, minimal food storage and no strong claim on territory. That led to the creation of a new model, known as 'the generalised foraging model' for the 'hunter-gatherer society'. The most critical part of that model, which captured wide attention, was the description of 'hunter-gatherer society' as 'the original affluent society' (Sahlins 1968: 85-89). In other words, hunter gatherers were projected as the people working fewer hours a week to satisfy their subsistence needs than many agriculturists and the people living in the industrial world. In addition, that model also highlighted plants, rather than meat, as the subsistence food in a hunter-gatherer society (Kelly 1995: 14).

However, that model was soon dismantled, for the new researches brought out a different picture. The so-called 'egalitarian' nature of the 'hunter-gatherer society' was also critiqued and deconstructed in a

later volume, *Prehistoric Hunter-Gatherers: The Emergence of Cultural complexity* that showed increasing evidence of prehistoric non-egalitarian hunter-gatherers in a variety of different environments (Price and Brown 1985). Others have also found that food was not shared equally, but the men and women in a hunter-gatherer camp ate different foods, with the women often eating less meat than the men did. The stress on plant food in the generalised foraging model also does not apply to all hunter-gatherers. In short, there is an increasing recognition of the variability and historicity of hunter-gatherer societies. This is crucial for both ethnographic and archaeological attempts to describe and explain distinct ways of life in relation to subsistence. With this context, the discussion now shifts to the Palaeolithic and mesolithic periods of the Indian subcontinent, which economically represent the hunting-and-gathering stage.

South Asia was brought within the sphere of scientific study of prehistory with the discovery of Palaeolithic tools at Palavarram in 1863 by Robert Bruce Foote. Being influenced by the revolutionary ideas proposed by Darwin, Frere, Lyell, de Mortillet, Boucher de Parthe and many others, he documented hundreds of sites in southern and western India and attempted to hypothesise on past environment and ancient life-ways (Pappu 1991-92: 647-654). Later on, the archaeological investigations carried out over the years, particularly after Independence, have established the Stone Age cultures of India on a firm footing. The data collected from different regions of the country have not only established the stratigraphic horizons, but also tool-typology, technology and ecology of Stone Age humans. By the 1960s, Indian prehistorians could confidently divide the Palaeolithic into lower, middle and upper Palaeolithic and mesolithic phases. Excavations at a number of sites have yielded a wealth of information on varied aspects of Indian prehistory. (**Fig. 4.1**) The same cannot be said about the faunal remains, which are scarce in the Indian Palaeolithic sites. However, this is not the case with the mesolithic sites, which have revealed rich organic remains. Therefore, after giving a brief background of the subsistence activities of the Palaeolithic hominids with whatever data is in hand, the chapter will mainly focus on the Mesolithic phase in the Indian subcontinent.

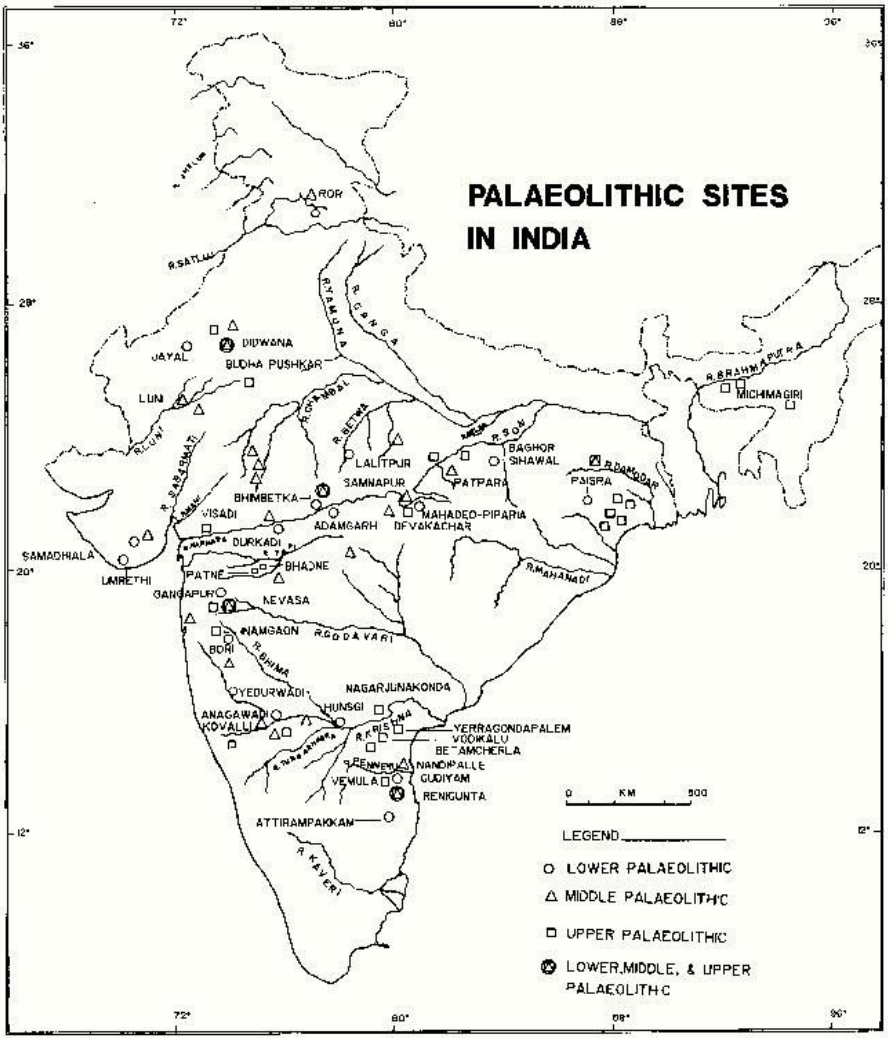

Fig. 4.1 Map showing Palaeolithic sites in India (Misra 2001)

The Lower and Middle Palaeolithic

The earliest human occupation of the Indian subcontinent is known from the lower Palaeolithic. Combined magnetic dates from the Riwat section, southeast of Rawalpindi and fission track dates from Siwalik Hills in Pakistan indicate an age possibly as early as two million years for the earliest manmade tools reported from the subcontinent (Dennell et al. 1988: 98-106). Two technological stages are defined from the lower Palaeolithic in the Indian subcontinent: (1) the Sohanian, which are mostly represented by the pebble tools, such as choppers and chopping tools, and (2) the Acheulian, represented by the hand axes, cleavers, pebbles, a variety of scrapers, flakes, blades and cores. The Sohanian tradition is known only from the Siwalik Hills in northwest India and Pakistan. As the first tools of that tradition were obtained in the valley of the Sohan, a tributary of the Indus, it is referred to as the Sohanian or Sohan culture. However, the first effective colonisation of South Asia was achieved by people associated with the Acheulian culture. Some scholars further divide the Acheulian into early and advanced phases on the typological and technological grounds. Palaeomagnetic measurements and direct $^{26}Al/^{10}Be$ burial dating of stone artefacts from the excavated site of Attirampakkam now position the earliest Acheulian levels as not younger than 1.07 million years ago (Pappu et al. 2011: 1596-1599).

Early hominids occupied almost all parts of India, except for the densely forested areas of the northeast, Kerala and the Gangetic plains. Sites are particularly richly concentrated in central India and the southern parts of Eastern Ghats.

The middle Palaeolithic succeeded the lower Palaeolithic. Dates for that period range from 150,000 to 20,000 years ago. The middle Palaeolithic sites are fewer and poorer than the lower Palaeolithic sites. That culture developed during the late Pleistocene period, which was partly a period of intense cold and glaciation in the Himalay and of intense aridity in the areas bordering glaciated regions (Misra 2001: 498). In general, the middle Palaeolithic hominids appear to have continued in the same areas that were occupied by the lower Palaeolithic people. In Europe, the Near East and Central Asia, the middle Palaeolithic sites are associated with the Neanderthal humans. Although, no bones of the Neanderthal have been found in the Indian subcontinent, yet the stone tools in general in the Indian subcontinent are quite comparable to those found within the known geographic

distribution of Neanderthals (Misra 2001: 495-496). Technologically, a decrease in the use of tools, like hand axes, cleavers and also the heavy core tools, such as choppers, polyhedrons, spheroids, and others has been noticed in that period. Scrapers of various types, denticulates, borers, notches and points were the most common tool types of that period. It is believed that many of scraper forms were used not only for manufacturing wooden tools and spears, but also for processing animal hides.

One of the greatest lacunae of the Indian Palaeolithic record, as mentioned above, is the paucity of faunal fossil or human remains. Very few faunal-lithic associations belonging to lower-middle Pleistocene sediments have been reported from the subcontinent. That is probably due to lack of faunal preservations in those older contexts. Considering that state, we virtually have no information about the subsistence activities of the lower and middle Palaeolithic people. The lower group of Narmada stratigraphy that yielded Acheulian tools has also yielded fossil evidence of extinct animals like elephant, pig, hippopotamus and horse (Badam 1979). The evidence of fossil fauna, like extinct cattle, extinct buffalo, crocodile, turtle and various types of deer and antelope species has also been reported from other alluvial contexts at a number of places. Those are all believed to belong to the middle Pleistocene period. However, none of those fauna has been found in association with the undisturbed occupation sites. Nevertheless, that evidence shows that in the Pleistocene, various ecosystems were supporting rich wild life and vegetation. There is little doubt that some of those animals formed a source of food for the prehistoric people. However, whether those animals were hunted, scavenged or exploited, can only be ascertained when their remains are found in association with the archaeological material in proper stratified contexts.

Direct evidence of faunal remains has been reported from the sites, like Isampur, Bori, Chirki-on-Pravara, Attirampakkam, Sadab, Teggihalli, Gaya, and Nittur, among others. The faunal remains from those sites suggest that extinct forms of wild cattle, wild buffalo, wild pig, wild horse, wild elephant and various types of deer and antelope species were being exploited for food purpose. The excavation at Isampur revealed evidence of shell remains of land turtle, indicating that the Palaeolithic groups also exploited small fauna (Paddayya et al. 2002: 641-647). Besides, the occurrence of mammal footprints (elephant and bovid) in association with Acheulian artefacts is also reported (Pappu et al. 2003: 591-598). The Hathnora site in the Narmada Valley has yielded a hominid calvaira (the dome of the skull) associated with the late Acheulian tools, which belongs to the archaic

Homo sapiens.

The Upper Palaeolithic

The upper Palaeolithic, which developed during the latter part of the upper Pleistocene, is the third and last sub-division of the Palaeolithic. A large number of radiocarbon dates from the upper Palaeolithic sites in central and western India, and the Eastern Ghats, range from about 40,000 to 10,000 years ago. Human colonisation and adaptations in that period were shaped by the semi-arid and arid climate of the last Glacial over much of the subcontinent. Sand sheets stretched over large parts of the northwest India, and the decrease in the rainfall and reduction in the vegetation cover on the valley slopes in the other areas led into the formation of alluvial sheets (Misra 2001: 496-498). Studies conducted in the coastal areas point to a drastic lowering of sea level. Those conditions not only led to the restriction in the distribution of settlements, but also resulted in the reduction of population. The upper Palaeolithic sites are plentiful in the relatively humid region of the Eastern Ghats, suggesting a concentration of the upper Palaeolithic population there (Murty 1979: 301-320).

The upper Palaeolithic tool assemblages are essentially characterised by blade and burin types of tools. Those tools also show a marked regional diversity with respect to the refinement of techniques and standardisation of finished tool forms (Misra 200:196). In addition to the new form of tools, raw material, such as bone, ivory and antler became very important in the upper Palaeolithic industries. Bone tools are mainly reported from the cave sites, but those are very scarce in the open-air sites, for those disintegrate under exposed conditions and the contexts in which they occur are unfavourable for preservation (Murty 1979: 301-320). Bone tools have been reported from the Kurnool caves and the Godavari Khani open-air site in Karimnagar district of Andhra Pradesh, and those have been described as the scrapers, perforators, chisels, scoops, shouldered points, barbs, spatula, worked bones and bone blanks (Murty 1979: 315). Singh has described the Godavari Khani bone tools as points, perforators, tanged arrowheads, chisels, scrapers, single shouldered points and worked bones (Singh 1984: 7-29).

As was the case with the lower Palaeolithic and upper Palaeolithic periods, faunal material from the late Pleistocene or the upper Palaeolithic phase in India is virtually absent, with only a handful of exceptions. Therefore, we are more or less unaware of the species and habitats of animals of that period. However, it is understandable

that the ancestors of the animals of the Holocene period must have flourished during the late Pleistocene or the upper Palaeolithic phase in India. The caves of Kurnool and Mutchatla and Chintamani Gavi represent the only known faunal contexts in India in well-preserved cave sediments. Those caves have revealed rich bone and stone tools industries of the upper Palaeolithic technology with vertebrate faunal remains. The fauna associated with those caves comprise species, like nilgai, blackbuck, gazelle, sambar, and spotted deer, barking deer, wild boar, mongoose and porcupine, among others (Murty 1981: 47-58). In addition, the remains of big games, like ox/buffalo, tiger, panther, and bear and so on, were also found in those caves. Many of the faunal remains from those cave deposits are charred and those reveal evidence of intentional breakage. That suggests that the upper Palaeolithic hunter-gatherers were able to exploit not only fleet-footed animals, but also big game. That shows that the upper Palaeolithic people made further strides in hunting technologies and strategies with the development of blade tool technologies. The late Pleistocene fauna from those caves indicate that those areas must have provided abundant game in the late Pleistocene and early Holocene times. However, it is important to note that the bones of cave dwelling animals, such as owls, bats, hyena, bears and cats are also likely to be found in cave deposits and consequently, may be found in association with the food refuse of the ancient cave dwelling predators and human beings.

In the hinterland, riverine ecosystems of the Eastern Ghats and the upper Palaeolithic sites have a considerable number of bored stones. Similar bored stones today are used by the Yanadis as net sinkers in riverine fishing, and the heavier ones are used by Voda Baliji and other groups for marine fishing. According to Murty:

> '...the bored stones associated with the Upper Palaeolithic at Ranigunta and Peddarajupalli, which are not heavy enough to have been either mace-heads or weights for digging sticks, were probably used as net sinkers. Nets, once developed as fishing aids, could also have been used as a trapping mechanism for other game, as can be attested by the use of a few types of net traps by the Yerukulas in the Kurnool cave areas.'
>
> *Murty 1981: 56.*

He believes that a variety of advanced hunting aids such as prototypes of the net traps, noose traps, spring traps, and gravity traps, and so on, might already have been developed by the upper Palaeolithic times.

Ostriches in the Indian Pleistocene

One noteworthy feature of the upper Palaeolithic fauna is the presence of ostrich. The ostrich, of which *Struthio camelus* is the only living representative, is found today only in Africa. However, by no means, was the ostrich always confined to Africa. There is clear evidence that the ostrich roamed over many parts of Asia, including India, until the end of the Pleistocene or early Holocene. Ostrich being one of the largest birds is unable to fly like most of the giant birds, though it may have descended from the flying relatives. Its powerful legs allow it to support a body weight of up to 150 kg and run at a speed of 50 to 70 km per hour for about half an hour (Badam 2005: 97). It prefers savannah grasslands and a semi-arid climate. These birds live in small troops of five or six, of which one is a cock and the rest, hens (Kumar 1997: 91). Ostrich eggs are quite large, often reaching 15 cm in length and up to two mm in thickness. These eggs weigh between 775 g to 1618 g. The shell of an egg is so hard that one has to use a hammer and saw to break it. Presently, the Bushmen of South Africa hunt it for meat, egg protein and feathers (Francis 1983: 142-146).

There are several gaps in our knowledge concerning the fossil records of ostriches in India, which makes the task of taxonomic assignment rather difficult. Falconer recognised the ostrich bones from unspecified Siwalik localities as early as 1847, and referred to them as *Struthio palaeindicus*. Later on, A. M. Edwards grouped those ostrich specimens under the species *Struthio asiaticus* (Sahni et al. 1990: 41). However, it was Lydekker, who made the earliest systematic description of the ostrich bones in India (Lydekker 1884:136-202). He described phalanges, tibia, fibula and vertebrae of *Struthio asiaticus* from the middle Siwaliks of northwest India. He also stressed the morphological similarity of ostrich bones from India with *Struthio camelus*, and considered the name *Struthio asiaticus* to be provisional. There is another record of 1935 about the ostrich remains from the Dhok Pathan stage of Hasnot in Pakistan. Eggshell pieces from that collection are now housed in the American Museum of Natural History (Sahni et al. 1990: 41-47). From the perusal of that account, it becomes clear that the biological and geological importance of ostrich remains has not received the attention that it deserves and that does not form a firm basis for tracing the evolutionary history of the Indian ostrich.

In the archaeological context, Carlleyle made the first discovery of ostrich eggshell in the 1860s in the Ken River in Banda district of Uttar Pradesh. However, the real momentum started, when in 1976 and 1980, eggshell pieces were discovered from the upper Palaeolithic

levels at Bhimbetka (Madhya Pradesh) and Patne (Maharashtra) (Badam 2005: 97-98). Discovery of ostrich eggshells at Patne, in particular, evoked considerable interest among scholars. Since then, ostrich eggshells have been discovered at a large number of sites in Rajasthan, Madhya Pradesh and Maharashtra. Those eggshell pieces are mostly found along with the upper Palaeolithic implements. The presence of eggshell pieces dated to 25,000-40,000 BP has also been reported in Kachchh district of Gujarat (Mohabey 1989: 477-481). (**Fig. 4.2**) Francis mentions that E. G. F. Sauer, a well-known authority on ostriches, after examining the ostrich eggshells from Patne, concluded that those were African in origin (Francis 1983: 143). However, the prospects of subsequent finds of ostrich eggshells in India are very bleak. In terms of the known sites of ostrich eggshell, Madhya Pradesh has 30 sites; Rajasthan, 14; Maharashtra, eight and Uttar Pradesh has one (Badam 2005: 97-104). The numbers of such sites may increase in future. The optical and microscopic studies of Sahni on the ostrich eggshell fragments, with a view to investigate whether the eggshell occurrences represent an endemic species of *Struthio* in India or not, also revealed that the late Pleistocene eggshell fragments from Indian contexts represent a taxon endemic to this region (Sahni 1992: 203206).

Fig. 4.2 Ostrich egg shells found in Gujarat

There are several depictions of birds in the upper Palaeolithic rock art,

which may belong to ostriches. (**Fig. 4.3**) (**Fig. 4.4**) For example, depictions of ostriches have been noted at Kathotia and Firangi, situated a few kilometres south of Bhopal, Bazaar-Cave in Panchmarhi and the Tipatia rock shelter in Kota, and so forth. However, identifications of those as ostriches have yet to be validated by the scholarly community. Several scholars believe that those depictions are just symbolic and not true depictions of ostriches.

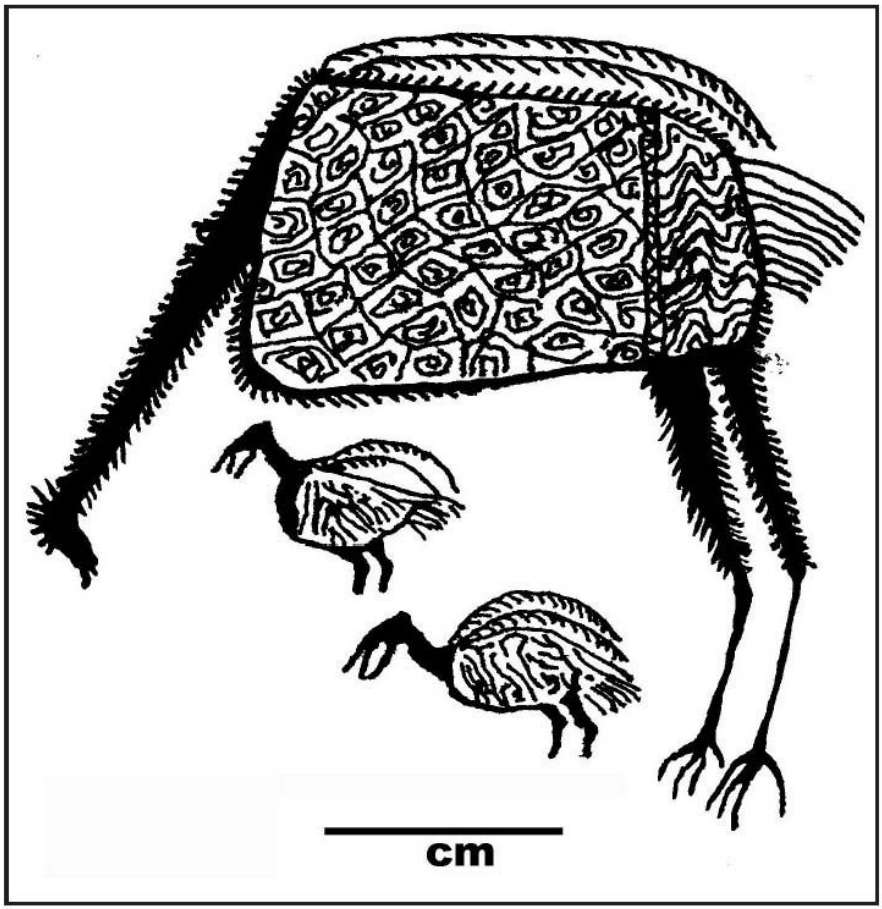

Fig. 4.3 Ostrich depiction in rock art (From Badam 2005)

Fig. 4.4 Ostrich depiction in rock art in Rajasthan (From Narayan J. et al. 2005)

The ostriches were hunted for their eggs, which when emptied might have served as water vessels, for the ceramics were not known to people in that period, or for providing a large quantity of protein that their big size offered. The use of ostrich eggshells as the water containers, vessels and bowls is well known in the ethnographic record, especially among the Bushmen of the Kalahari Basin in South Africa (Bednarik 1993: 34-43).

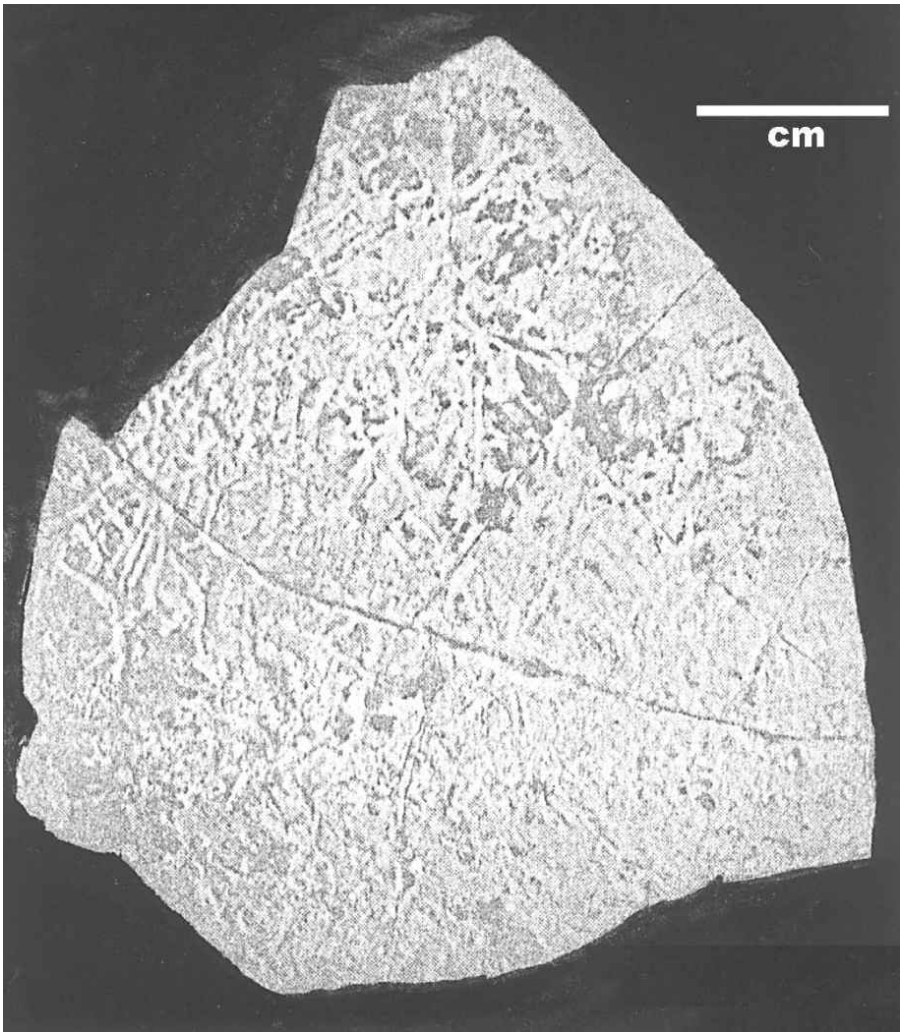

Fig. 4.5 Ostrich egg shell bearing engraving from Patne, Maharashtra

Another important use of the ostrich eggshell, for which there is good archaeological evidence, was for making beads. In his dissertation, Sali reported the presence of ostrich eggshell beads from the late phase of the upper Palaeolithic site at Patne in Maharashtra. (Fig. 4.5) Wakankar also discovered two small circular beads around the neck of a skeleton from the upper Palaeolithic deposits in a rock shelter at Bhimbetka (Kumar et al. 1990: 2940). These finds indicate that the ostrich eggshells were an important raw material for the Palaeolithic bead production.

Besides, ostrich eggshell pieces were decorated with the engraved designs (Kumar et al. 1988: 43-53). However, the article became a hot topic of discussion and it was debated by various scholars.

The Palaeolithic use of ostrich eggshells for utilitarian, decorative and ornamental purposes is not at all restricted to India. Evidences of such use have also been found in other parts of the world.

Ostriches reportedly disappeared from India after the upper Palaeolithic. For that, different reasons have been assigned with different perspectives. The main reason for their extinction may be the climatic changes at the end of the Pleistocene. The other reason may be the overexploitation of ostriches for meat, egg protein, feathers and empty shells (Francis 1983: 143). Yet another cause for disappearance of ostriches in India may be the spread of an epidemic (Badam 2005: 97-104).

The Mesolithic

The Pleistocene geological era made way for the Holocene about 10,000 years ago. That transition took place along with many environmental changes. That transition also witnessed changes in the stone tool kits of prehistoric people to give rise to the mesolithic phase. The term ‘mesolithic’ appeared in the late 19th century, more or less at the same period in England and France, to represent a residual category of the lithic industry between the Palaeolithic and the Neolithic periods.

The Mesolithic Age or the middle Stone Age is best known for its distinctive technology, based on a wide range of small tools, known as the ‘microliths’. The microliths range in length from one to five centimetres. While microliths include miniature versions of some of the upper Palaeolithic tools types, there is also the introduction of tools in geometric shapes such as crescents, triangles, trapezes and trapezoids. Because of that, the microliths are generally classified as ‘non-geometric’ and ‘geometric’ types. Those tiny tools were not used individually, but a series of tools was arranged in a grove in a bone or wooden handle or shaft and glued together by some adhesive, like gum, resin or bitumen. In some instances, the original hafts have survived. A variety of tools and weapons like knives, sickles, daggers, harpoons, arrowheads and spearheads were prepared in that way. The term ‘Epipaleolithic’ is sometimes used to denote the transitional stage, where tools are smaller than the upper Palaeolithic tools, but larger than microliths. The pace of cultural evolution during the Mesolithic was very fast compared to that in the Palaeolithic period, which was of a much longer duration.

As far as the Indian archaeology is concerned, microliths were first discovered in India as early as 1867-68. The mesolithic sites in India are not only better preserved, but also larger in number than the Palaeolithic ones, as the land surfaces of the country (particularly river basins) are still in the same shape as these were at the end of Pleistocene Epoch: undisturbed by the natural agencies, like climatic (Misra 2007: 132-133). The mesolithic sites have been reported from different ecological zones. For example, the arid and semi-arid sandy plains of the western Rajasthan and Gujarat, the rocky plateau of Mewar, the hilly and forested country of Central India, the hilly tracts of Odisha, the Chhota Nagpur plateau, the semi-arid and rocky Deccan plateau, the Mumbai coast, the Telangana plateau and the Eastern

Ghats. Additionally, the mesolithic people colonised new and virgin areas, like the Ganga Valley, the Damodar Valley, the Kerala coast, and the southern Tamil Nadu coast (Misra 2001: 498). (**Fig. 4.6**)

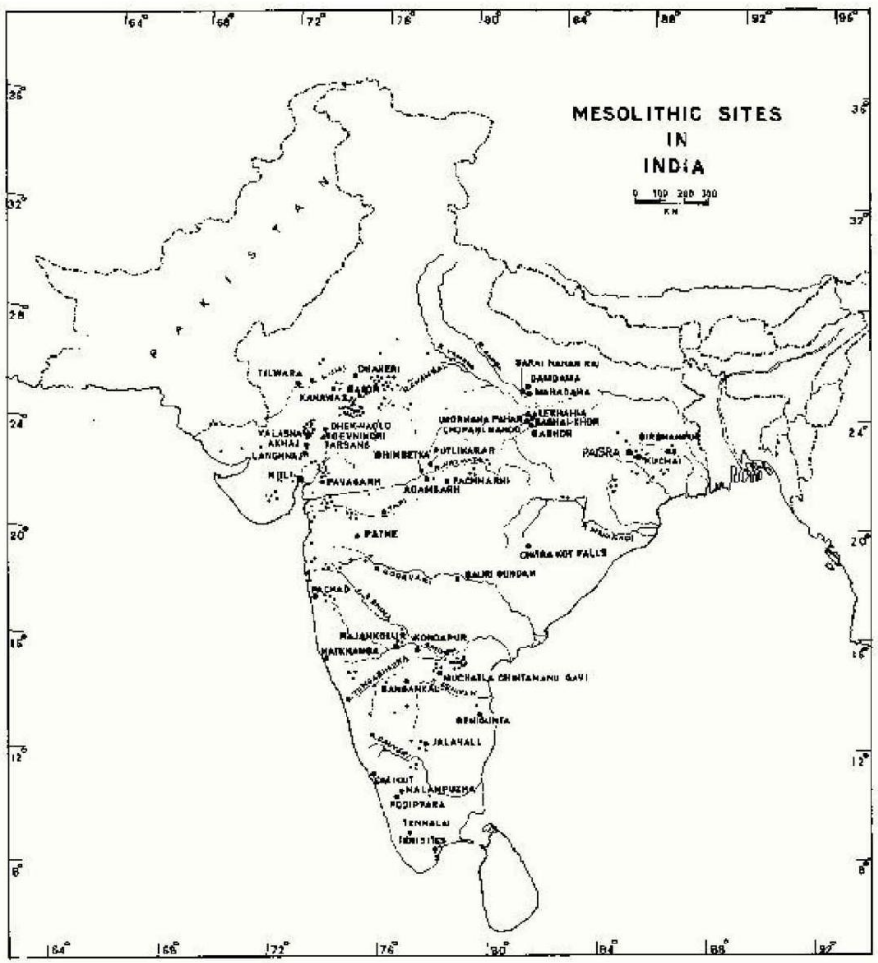

Fig. 4.6 Map showing Mesolithic sites in India (Misra 2001)

It is also important to mention that there is a heavy concentration of mesolithic sites in some areas, while the others are thinly scattered. The increased number of mesolithic sites indicates demographic increase during the period, seemingly due to the marked increase in the rainfall. The palynological and sedimentological studies have revealed that at the beginning of Holocene, not only did rainfall increase, but lakes were also carrying water, though irregularly to begin with. The other factors, like large-scale migration and intermingling of people and easy availability of food due to the more efficient hunting kits and trapping techniques, could have also contributed to the increase in number of mesolithic sites (Varma 1999:

184),.

Although, no standard typology of the Indian mesolithic tools is available, yet considerable technological and typological diversity is noticed in the mesolithic industries of India. While the industries of north, central and western India are characterised mainly by the geometric microliths, the industries of the south are distinguished primarily by the non-geometric tools. Some other mesolithic features are the regular disposal of the dead by burial and the art in the form of paintings and engravings in rock shelters and caves. Paintings are particularly prolific in the natural caves and rock shelters in the central India and the adjoining regions of Rajasthan, Chhattisgarh, Jharkhand and Odisha. The mesolithic art in various manifestations is a reflection of mesolithic man's aesthetic sensibilities, and it throws considerable light on his technology, material culture, social organisation and religion (Misra and Nagar 2009: 43). The chronology of mesolithic period in India is still far from securely established, because of the paucity of radiocarbon dates. There is a calibrated range of dates from the mesolithic sites, which shows that the mesolithic tradition flourished from the early to late Holocene, crosscutting in certain cases, Bronze Age or the chalcolithic traditions. The mesolithic economy, like the Palaeolithic one, was still essentially based on hunting and gathering. However, some sites have yielded the presence of domestic animals.

Mesolithic Sites from Rajasthan

The dominating feature of the physiography of Rajasthan is the Aravalli mountain range. It divides this region into two parts: the western and the eastern. These two areas differ markedly in their physical features, cultural patterns, climate and vegetation. The eastern part is mostly rocky and uneven, except near the foothills, where one can see large tracts of alluvium. On the other hand, western Rajasthan is a vast sandy plain with only the occasional hills and the frequent sand dunes, relieving the monotony of its flatness. Mesolithic sites have been located in both these regions. In the western Rajasthan, chert was used for producing microliths and in the eastern part; chert, jasper, chalcedony, quartzite and quartz were used. At present, more than 150 sites of the mesolithic period are known in Rajasthan. However, the most important evidence for the mesolithic culture comes from the two excavated sites of Bagor and Tilwara.

Bagor, located in the centre of Mewar Plain in the shadow of the Aravalli hills is a very important mesolithic site in Rajasthan. The habitation deposit at that site revealed regular occupation over a

period of five millennia without any stratigraphical break. Three different phases of occupation at that site are recognised, based on the changes in material culture: 'Phase I' (*c.* 5000-2800 BCE), 'Phase II' (*c.* 2800-600 BCE) and 'Phase III' (*c.* 600 BCE-CE 200) (Misra 2007: 139). The 'Phase I' yielded microliths and animal bones in large quantities, besides one human burial, stone-paved floors, querns and rubbers were found. In the 'Phase II', the quantity of microliths and animal remains began to decline. Pottery (handmade) and copper objects make their appearance. In addition, beads of agate, carnelian, garnet and three human burials were also found in that phase. The final phase at the site revealed a further decline in microliths and animal bones. The pottery (wheel made), glass beads, stone pendants, brick fragments, arrowheads and several bits of iron, were the artefacts recovered from this phase (Misra 2007: 139).

Shinde et al. have stated in their recent publication that new excavations at Bagor have revealed two phases of the Mesolithic: (1) 'Phase A': Aceramic Mesolithic) and (2) 'Phase B': Ceramic Mesolithic (Shinde *et al* 2004: 383-406). They have also published AMS (Accelerator Mass Spectrometry) and radiocarbon dates for those phases as: 5680 cal. BCE for 'Phase A' and 4490 cal. BCE for 'Phase B'. However, for the present discussion, the original phase configuration has been used.

Shah initially studied the faunal remains recovered from the Bagor site, and reported the presence of a number of wild animals at that site (Shah 1971a: 319-320). A part of that collection was subsequently studied and that revealed presence of caprine (sheep and goat), and to a lesser degree, cattle, as the most commonly represented taxa (Alur 1990: 224-231). Study of the animal remains later on revealed the presence of both wild and domestic species from the very beginning at that site (Thomas 1975: 322328). The quantified data of Thomas from the first phase of the site revealed the presence of cattle (15.71 percent) and sheep/goats (64.43 percent). Among the sheep/goat bones, Thomas confirmed the identification of sheep alone. Often, drill marks are noticed on the phalanges of those animals, probably used either as pendants or as whistles. The other animals that Thomas identified include swine (both wild and domestic) (3.7 percent), buffalo (0.8 percent), blackbuck and gazelle (together constituting 4.4 percent), spotted deer (4.29 percent), sambar (4.29 percent), hare (0.6 percent), mongoose (0.8 percent) and Indian fox (0.5 percent). In addition, Thomas had reported the bones of other animals, like porcupine, rat, tortoise, fish and frog. Complete and intact bones of rats at the site suggest that those bones may not be contemporary with the prehistoric occupation, but may be later intrusions. In addition to

the above taxa, hog deer, *barasingha*, jackal, the river turtle and monitor lizard were identified by Shah (1971a: 319-320) from the assemblage.

The mesolithic site of Tilwara lies about two km southwest of the modern Tilwara village in the Barmer district of Rajasthan. Two phases of occupation have been distinguished at this site. The 'Phase I' was represented by an abundance of microliths with stray potsherds and the 'Phase II' was marked by a declining microlithic industry, but with plenty of pottery. Thus, the 'Phase I' appears to be a truly mesolithic and aceramic occupation. The chronology of the site is insecure in the absence of radiocarbon dates, but the excavators date the lower phase to about the middle phase of the first millennium BCE (Misra 2007: 138). A meagre amount of faunal remains has been recovered from the site. The examination of those animal bones by D. R. Shah revealed the presence of cattle (domestic form), goat, jackal or dog, pig, spotted deer, hog deer and mongoose (Misra 2007: 137-138). Of those, cattle bones were the most common. The fauna is said to be a mixture of wild and domesticated species. However, it is not clear if that situation existed right from the beginning or domesticated animals appeared later. Later on, Thomas also studied the material and reported the presence of two domestic animals (cattle and sheep/goats). He also reported the presence of a broken third molar of *Equus* species from the assemblage (Thomas 1975: 322-328). As at Bagor, at Tilwara, too, the economy seems to have been a combination of hunting and raising stock. Misra posits that the spherical stone balls found at the site are likely to have been used for hunting (Misra 2007: 138).

Mesolithic Sites from Gujarat

A large number of mesolithic sites have been discovered from different parts of Gujarat. Those sites are widespread, comprising a vast and diverse set of interconnecting ecosystems, which favoured the indigenous development of material culture by subsisting on the local environment. Mesolithic sites found in Gujarat are characterised by their association with the various types of aeolian landforms. Among those, the most common are aligned relict sand dunes. A large number of mesolithic sites of Gujarat have been excavated in varying degrees, depending upon the nature of settlements and the aims of the excavation. Langhnaj, Loteswar and Santhali are some of the important mesolithic sites in Gujarat, from where faunal remains have been studied. Following is a brief review of those sites highlighting the specific results in favour of drawing conclusions.

The site of Langhnaj is situated about 60 km north of Ahmedabad in Mehsana district of the north Gujarat. The excavations at the site by Sankalia from Deccan College, Pune revealed a sandy deposit of about two metres, divisible into three phases. The entire habitation deposit was characterised by the presence of both geometric and non-geometric tool types made on cryptocrystalline silica. The 'Phase I' revealed the presence of human burials, animal bones and occasional potsherds in the upper margins. All those traits show proliferation in 'Phase II'. In addition, two ground stone axes, a ring stone, a copper knife and steatite disc beads were also recovered from that phase. The 'Phase III' revealed a tanged iron arrowhead. Pottery was quite abundant and better preserved during that phase. There is one radiocarbon determination from 'Phase II' at Langhnaj, which calibrates to 2440-2160 BCE (Possehl 1999). That perfectly corroborates the time bracket of the chalcolithic occupation in Gujarat. This date and the occurrence of pottery and copper knife at the site indicate that the mesolithic people at Langhnaj had contacts with the settled agricultural communities in Gujarat (see Chapter 6).

The faunal remains from Langhnaj were first examined by F. E. Zeuner, the well-known expert on Quaternary climate and environment, at the Institute of Archaeology, University of London. He was invited by Sankalia in 1949 to examine the possibility of presence of a buried soil horizon in the sand dune deposit at Langhnaj (Misra 2002: 7). He reported the presence of Indian rhinoceros, the hog deer, nilgai, blackbuck, mongoose and possibly, wild buffalo (Zeuner 1952: 129). He also noted the presence of some brushings on a rhinoceros shoulder blade and drew the inference that the bone had probably been used as an anvil for producing microliths at the site (Zeuner 1952: 130). Zeuner returned to India in 1962 to deliver lectures at the M. S. University of Baroda on prehistory and Quaternary environment of India. While returning, Zeuner took the faunal material recovered from Langhnaj with him to London, where it was studied by his student, Juliet Clutton-Brock (Misra 2002: 7). The results of that study were later published as a monograph by Deccan College, Pune.

Clutton-Brock's analysis also confirmed the presence of mongoose, rhinoceros, hog deer, nilgai and blackbuck at the site. In addition, she also reported the presence of swamp deer, spotted deer, wolf, and wild boar. The remains of rhinoceros consisted of a left scapula, a right humerus, a talus, and a fragment of tooth. Furthermore, teeth and bones of an undetermined bovine species were also recorded from the assemblage. According to her, the extinct bovine species that might be represented by the Langhnaj bones and teeth is most likely the Pleistocene species of wild cattle (*Bos namadicus*) (Clutton-Brock

1965: 25). Thomas and Joglekar also prefer to call the bovine bones from Langhnaj as those of wild cattle. Except for the remains of wolf and mongoose, the bones and teeth of all other animals show that those animals were killed for food (Thomas and Joglekar 1994: 182-184). The charring on the bones suggests that cooking was done over an open fire. Chattopadhyaya states that non-reporting of smaller fauna, such as fish and turtle at the site shows a bias in either the method of or attitude towards recovery. It is unthinkable, according to him, that the aquatic resources of the nearby Luni River were not utilised by the mesolithic occupants of the site. The type of faunal assemblage that has been reported from Langhnaj indicates that perennial water was available in Gujarat at the time of the microlithic habitation of the site (Chattopadhyaya 2002: 373).

The site of Loteswar, located on the margin of a salty waste depression east of the Little Rann of Kachchh, is one of the sites in north Gujarat with both mesolithic and chalcolithic deposits. The mesolithic component, 'Period I', at that site was found stratified below the chalcolithic, 'Period II'. The mesolithic period revealed the presence of small shouldered bone points, a few prismatic red and yellow ochre crayons, and two human burials. The analysis of the faunal remains recovered from the microlithic layers revealed the remains of wild animals only. The animals identified in the assemblage included gazelle, boar, wild cattle, wild water buffalo, nilgai, wild ass, blackbuck, spotted deer and hog deer (Patel 2009: 178). However, it was the bones of blackbuck, which seem to have dominated the assemblage. Three bones from that microlithic phase were dated using the AMS technique. Those dates provide a range for microlithic phase at Loteswar of 1500-1800 years between the late eighth and mid-sixth millennium cal. BCE (Patel 2008: 129). That makes the microlithic phase at the site of Loteswar partly contemporary with the aceramic neolithic levels at Mehrgarh and earlier than the mesolithic Bagor (Patel 2008: 129).

The site of Santhali, located in Banskantha district of north Gujarat, is another site that has given the evidence of Mesolithic, 'Period I', and chalcolithic, 'Period II'. Although, there are no dates from Santhali, both mesolithic and chalcolithic components at that site are likely to be more or less contemporary with those at Loteshwar. The mesolithic stratum at Santhali revealed clusters of skulls and post-cranial material from at least eight water buffaloes, together with the bones of other wild animals including blackbuck. While Loteshwar, during the mcrolithic phase, may have been a hunting station primarily for blackbuck, Santhali seems to have been a killing station primarily for water buffalo (Meadow and Patel 2002: 399).

Mesolithic Sites from Madhya Pradesh

Mesolithic people inhabited caves and rock shelters of the densely wooded hilly country of central India, such as those found in Madhya Pradesh. The forests here might have provided an abundant supply of both plant and animal foods. Two important sites in that region from where faunal remains have been studied are Bhimbetka and Adamgarh. Bhimbetka is the local name of a hill near the village of Bhiyanpur located on the northern margin of the Vindhya Hills in Raisen district of Madhya Pradesh. The place is located 45 km south of Bhopal. The name Bhimbetka has been given to it because of a myth that it was the 'sitting place of Bheem', a brave Pandav. Standing over the hill of Bhimbetka is a series of tall and massive rocks running in a straight line. A number of caves and rock shelters are located at the foot of those rocks as well as on the hill slopes. Those caves and rock shelters became famous due to the presence of a large number of prehistoric paintings. The Poona University excavated the habitation deposits in some of those caves. That excavation revealed a cultural sequence that ranged from the lower Palaeolithic to the Mesolithic. The mesolithic culture of Bhimbetka is well defined. During that period, the maximum number of caves in Bhimbetka was occupied. The excavation also revealed the presence of human burials, which indicates that the mesolithic people buried their dead within the caves in the living areas.

The faunal remains recovered at Bhimbetka showed the presence of domestic cattle, *barasingha*, hog deer and rhinoceros (Misra 1989: 17-33). The mesolithic period at this site has been radiometrically dated to the fifth millennium BCE.

Another important mesolithic site in Madhya Pradesh is Adamgarh. The site is located near the Hoshangabad district of Madhya Pradesh. Nath studied the faunal remains from Adamgarh. The analysis revealed presence of both domestic (cattle, sheep, goats, pigs and dogs) and wild mammals (spotted deer, *barasingha*, sambar, porcupine, hare and an unknown species of the genus *Equus*. In addition, a lizard (*Varanus grisius*) was also identified by the presence of an incomplete lumber vertebra. Besides, a few buffalo bones have also been identified, which show stronger inclination towards the wild variety, being stouter and bearing strong muscular ridges on them. The bones in most of the cases were found to be fragmentary and fragile in nature (Nath 1967: 28, 32). There are two conflicting radiocarbon dates from the site, one of that is based on an un-charred bone recovered 1.90 m below the surface and second on a shell collected at a depth of 0.15-0.20 m. Those are 2,765±105 BP (first millennium

BCE) and 7,240±125 BP (sixth millennium BCE) respectively. The authenticity of the date sixth millennium BCE is doubtful, as possibly the sample involved might have entered the site, not as a living organism, but in its long dead form (Chattopadhyaya 2002: 375).

Mesolithic Cultures of Ganga Valley and the Vindhyas

The Vindhyas are dotted with the mesolithic sites: more than 200 sites have been recorded in this region and about the same number in the Ganga Valley. The wide distribution of mesolithic sites in those regions clearly shows a substantial growth in human population. While in the Vindhyas, mesolithic sites have been recorded either as the open-air settlements or in the rock shelters, the occurrence of mesolithic sites in the Ganga Valley has been noticed to occur on the old banks of Ganga or near the horseshoe lakes.

Considerably detailed data regarding the faunal remains of mesolithic sites of this region is available in various published works. The studied important mesolithic sites are Sarai Nahar Rai, Mahadaha, Damdama (sites of Ganga Valley) and Chopani-Mando (site of the adjacent Vindhyan plateau). Of those, the sites of Sarai Nahar Rai, Mahadaha and Damdama, located between 40 and 80 km north of Allahabad, have provided interesting faunal evidence of both geometric microliths and onsite human burial practices. While the sites of Sarai Nahar Rai and Mahadaha are located on the oxbow lakes, the site of Damdama is located on a raised area at the confluence of two branches of a tributary of the Pili Nadi that flows into the River Sai. All the three sites have thrown light on similar sort of mortuary evidence, such as burial of individuals in an extended position, the presence of earthen tumuli on some of the graves and alignment of burials in west-east or east-west directions. Those mesolithic sites have also yielded the evidence of burnt plastered floors, charred seeds, querns, mullers, ring stones, sling stones and tools made of bone and antler.

The identification of faunal remains from the site of Sarai Nahar Rai and Mahadaha that Alur did revealed the presence of cattle, bison, sheep, goat, deer, stag, hippopotamus (*Hippopotamus palaeindicus*) and tortoise. Additionally, bones of swine (*Sus scrofa*), horse (*Equidae*), carnivores, rat, fish and birds were identified from Mahadaha, and elephant (*Elephas indicus*) from Sarai Nahar Rai. The bones of cattle, which dominated the faunal assemblage, belonged both to the large and medium sized animals. He states that from the study of their morphological characters and the compositional change

in the bones, it has been assessed that those exhibit affinities to the wild species. The position regarding sheep/ goats was found to be quite different. According to him, in contrast to the cattle, there appears to be a mixed group, in which various breeds can be noticed from the disparity in sizes of bones. That may establish the presence of wild variety of sheep/ goats at the site (Alur 1980: 201-280). While Alur was very unambiguous about the wild affinity of cattle, sheep and goat present at those sites, some of his statements point towards the presence of domestic animals (cattle, sheep and goat) also. For instance, he says, 'In cattle and sheep/ goats majority of the animals indicated their wild affinity, while in all other animals the entire flock was of wild origin' (Alur 1980: 210). That led to the recognition of the presence of those domestic animals in the mesolithic sites of Ganga Valley in the subsequent publications. Regarding the identification of horse at Mahadaha, Chattopadhyaya is of the opinion that this evidence may represent the presence of the extinct species of horse (*Equus namadicus*) or the Asiatic ass (*Equus hemionus*) or domestic ass at the site, but certainly not horse. According to him, the former three species prefer arid climatic conditions and the remains of the extinct species of horse and Asiatic ass have been recovered from the terminal Pleistocene deposits in the Belan and Son valleys, witnessing dry conditions (Chattopadhyaya 2002: 376). Therefore, in all probability, that species was not a local dweller of the Ganga Valley, and its occurrence in Ganga Valley requires further investigation.

Alur's study of the faunal remains from those sites was followed by Chattopadhyaya's study of the same material, as well as some additional material excavated from the sites of Mahadaha and Damdama, as part of his doctoral study at Cambridge. Later on, Thomas and Joglekar completed the study of entire assemblage excavated from Damdama, and Joglekar studied the assemblage recovered from Mahadaha. Those studies did not reveal the presence of any of the domestic animals in those sites. Chattopadhyaya states that the presence of sheep/goats, wild or domesticated, could not be confirmed in the faunal assemblages recovered from those sites (Chattopadhyaya 2002: 376). Similarly, 'At Damdama, not only is there absence of evidence of domestic animals, but the probable domesticates are also absent to infer local domestication of cattle and sheep/goat' (Thomas et al. 2002: 374-375).

In addition to the presence of wild goats at the site of Mahadaha and Damdama, analyses of faunal remains from those sites also revealed a large number of animal species. Those included large beasts (gaur, wild buffalo, Indian sloth beer and rhinoceros), deer (sambar, *barasingha*, spotted deer, hog deer, barking deer and mouse deer),

antelopes (four horned antelope, blackbuck and *chinkara*), swine (wild boar and pigmy hog), canids (wolf and jackal), felids (jungle cat, panther and tiger), nilgai, Indian hare, mongoose, porcupine and elephant, and so on. Additionally the bones of rodents, reptiles, birds and fish were also identified from those sites (Thomas et al. 1995a: 29-36; Joglekar et al. 2003). On the occurrence of a few bones of large mammals like elephant, rhinoceros, gaur, wild buffalo and other large-sized undetermined species of *Bos*, Thomas et al. noticed that 'It is difficult to believe that the mesolithic people hunted such large beasts for food' (Thomas et al. 1995a: 31). (**Fig. 4.7**) They suggest that probably the carcasses or the isolated bones of those animals were collected and utilised for making bone tools, because apart from being a hunter, man was also a scavenger at that time. On the presence of foreign species of gaur (*Bos gaurus*) and pigmy swine (*Sus salvanius*) at the mesolithic sites of Ganga Valley, They observe:

Fig. 4.7 Elephant ribs from Damdama, Uttar Pradesh

The gaur or Indian bison is an animal typical of high altitude and hilly areas, whereas the topography of the Ganga Valley around the site is a plain with alluvial fills and not a suitable habitat for the gaur. Now the question arises, if the gaur is not native to the Ganga Valley, then where has this animal come from. It is necessary to remember that the raw material which was used for making the microliths was also not available in the vicinity of these sites. Possibly, the Mesolithic people might have crossed the Ganga and obtained the raw material from the Vindhyas. This fails to explain the presence of the pig species—*Sus salvanius*—a tiny animal, smaller than a cat, which is confined to the Tarai region. Thus a possibility exists that during the winter season some of these animals may have migrated to the plains where they were killed by

> predators or trapped by man. At our present level of understanding of the Ganga Valley Mesolithic sites, it is still an open question, whether these animals were from the Vindhyas or from the Tarai region.
>
> *Thomas et al. 1995a: 32.*

We may now refer to the Chattopadhyaya's observations on the subsistence and settlement pattern in the Vindhyas and Ganga Valley. The mesolithic sites of Ganga Valley were generally viewed as temporary camp sites seasonally occupied by the people of Vindhyan region during the summer months. Based on the faunal remains, Chattopadhyaya probed that matter. He calculated the age-pattern of hog deer and swamp deer based on the cheek teeth from Mahadaha and Damdama. The results of his study revealed that hunting of those animals was not a seasonal, but a year round activity. That dental evidence is further corroborated by the presence of bandicoot rats (*Bandicota bengalensis*), a commensal of humans, at the sites of Mahadaha and Damdama. That species cannot establish itself at a habitation site unless food is available all year round. In addition, astro-archaeological evidence of grave orientation patterns in relation to the annual solar path variation across the horizon also suggests that burials took place both in summer and winter. Because of that evidence, he argued that mesolithic population at those sites followed a strategy of year round occupation coupled with the 'logistic mobility'. He states that the available evidence from the sites of Mahadaha and Damdama suggest that during the mesolithic times, some groups stayed back and occupied those sites on a permanent basis, while task-specific groups made periodic journeys in connection with the food quest or for other reasons. He further observes that the evidence coming from both the Ganga Valley and the Vindhyas suggests that, in spite of a possible wide range of economic activities, those societies organised themselves at much simpler levels of technology and with less developed storage facilities than those of higher altitudes (Chattopadhyaya 1996: 461-476, 2008: 89-101). He also proposes that aquatic animals, such as fish and tortoise, would have been important food resources for those mesolithic communities and that could have been factor favouring residential stability in the Ganga Valley. His comments in this regard are quite revealing, indicating that the control of mesolithic people over those aquatic resources in Ganga Valley would have played an important role in the acquisition of raw material from the Vindhyas. He says,

> ...the Ganga Valley presented a very special case where the cultural continuity of societies depended upon the influx of stone raw materials (a limited resource) from the Vindhyas, and the

> residential stability among the Mesolithic Ganga populations was part of an adaptive processes (under threatened conditions of reproduction), directed towards securing control over economic/ industrial productivity that would, in turn, either facilitate large-scale acquisition of exotic stones or minimize such a dependence.
>
> *Chattopadhyaya 2002: 379.*

He further suggests that the growing population of those mesolithic people might have led not only to conflict, but also to competition over those resources. That may have been the stimulus for the people coming and functioning as corporate groups and staking their claim to territory through burial practices and burial symbolism.

As far as the information about the animal bones from the site of Chopani-Mando is concerned, the faunal evidence is meagre. In all, 91 specimens were examined from 'Phase III'— the 'Advanced Mesolithic Phase'. Of those, only two could yield to identification as the rest were too fragmentary to assess either their affiliation to the body of the animals or to judge their use and utility to the human society (Alur 1980: 206). The animals identified were cattle and sheep/goats of wild variety. However, Chattopadhyaya, in his Ph. D. dissertation, later on revised the identification of the sheep/goat horn core from that site to be that of an antler of a deer (*Axis* sp.). In addition, deer (*Cervidae*), wild cattle and sambar have also been identified from the Lekhahia rock-shelter in the Kaimur Range (Mirzapur district of Uttar Pradesh) and from Baghor II in the middle Son Valley, dated to the seventh millennium BCE. Based on the hoof marks, the presence of sambar was detected in the context of a short stratigraphic break, when the site was temporarily abandoned (Chattopadhyaya 2002: 382).

Bone Objects of the Mesolithic Period

The mesolithic people are best known for their distinctive technology known as moicroliths, but they also used bones for making tools and ornaments. Excavated mesolithic sites in India have revealed a sizeable number of bone objects and those objects constitute an important segment among the excavated antiquities of the mesolithic period. While almost all the mesolithic sites have revealed artefacts made of bones and other organic material, the best evidence for bone and antler work came from the sites in the Ganga Valley. The same are discussed here in some detail.

The sites of Sarai Nahar Rai, Mahadaha and Damdama are the important mesolithic sites in Ganga Valley that have yielded a corpus of artefacts made of bones and antlers. **(Figs. 4.8 to 4.10)** The site of

Sarai Nahar Rai revealed a large number of worked bone pieces with use mark. Those included the ribs of large ungulates, shaped into scrapers and knives, and a large number of split long bones with the pointed edges, perhaps used as digging tools. As many as 45 bone implements have been recorded from Mahadaha. Those include arrowheads, points, blades, knives, scrapers and so on (Gupta 2002: 306-312). In addition to those bone implements, the site also brought to light 26 bone ornaments, both in the finished and unfinished forms. All those were fashioned on antler. The finished ornaments included an earring and a necklace. Of those, a necklace consisting of 11 small rings around the neck of an individual in one of the graves was one of the important findings (Sharma et al. 1980: 108). At the site of Damdama, both excavations and surface exploration yielded a rich crop of tools and weapons fashioned out of bone. Excavations at the site yielded more than 100 bone objects that include bone arrowheads, pendants and bangles, and so on (Verma et al. 1985: 63).

Fig. 4.8 Bone disc from Jhusi

Fig. 4.9 Bone tools from Mahadaha, Uttar Pradesh

Fig. 4.10 Bone tools from Damdama, Uttar Pradesh

Among all the bone objects, the bone arrowheads exhibited the high workmanship of the mesolithic people and it seems that those people had attained a highly developed technique for the manufacture of those. Those bone arrowheads were usually oval or circular in section. While both the ends of bone arrowheads had tapering ends, one end was more pointed and sharper than the other was. That shows that one end was used for hafting in the wooden shaft of the arrow and the other (pointed and sharper one) was the actual working point. Arrowheads were generally made from the split long bones or horn core. The discovery of a shining concave bone object with two perforations, along with two bone arrowheads suggest the use of that object as a quiver in which arrows could be carried (Pal 1994: 97).

The sites of Sarai Nahar Rai, Mahadaha and Damdama not only revealed a large number of tools fashioned using bones and antlers, but also yielded evidence that suggest that the mesolithic population at those sites were engaged in the regular manufacture of bone and antler artefacts, and those sites essentially were the bone-antler 'factory sites'. According to Chattopadhyaya that supplemented the conventional stone tools, for the stones was locally non-available (Chattopadhyaya 2002: 381). Most of the bones recovered from those sites were hard and heavily charred and probably fired between 300° and 500° C. That controlled heating of bones to such a high temperature not only facilitated smooth flaking for making artefacts in comparison to the raw bones, but also provided hardness and durability. A number of pit hearths containing burnt, longitudinally split bones of large ungulates and tools made of bones and antlers have been recovered from those mesolithic sites. Mention can be made of a bone and antler dump found at Mahadaha. That dump revealed both tools (scrapers, points, awls, daggers and sledgehammer) and objects (drinking vessel and ornaments) made of long bones and antlers in various stages of manufacture. The bones recovered from those mesolithic sites were devoid of any traces of gnawing and pitting, despite the presence of carnivore remains at the site. In addition, the long bones revealed a high degree of fragmentation. That was largely because of bone modification by human agency for regular manufacture of bone and antler artefacts (Chattopadhyaya 2002: 381).

Mesolithic Rock Art

Another significant feature of the mesolithic period is the art, mostly paintings. The study of the material contents of life, as depicted in many of those paintings, is an important source of study of the mesolithic life in India. The densest distribution of such paintings seems to be in the central India, across the entire east-west length of its hilly section. A large number of painted rock-shelters are known from Bhimbetka in Bhopal, Raisen and Panchmarhi in Madhya Pradesh and the south Mirzapur in Uttar Pradesh. At most mesolithic sites of the rock art, wild animals dominate the scenes. **(Fig. 4.11)** **(Fig. 4.12)** Those animals are depicted either on their own or as part of hunting scenes. (**Fig. 4.13**).

Fig. 4.11 Rock painting depicting wild animals, Bhimbetka, Madhya Pradesh (Courtesy: Toshabanta Padhan)

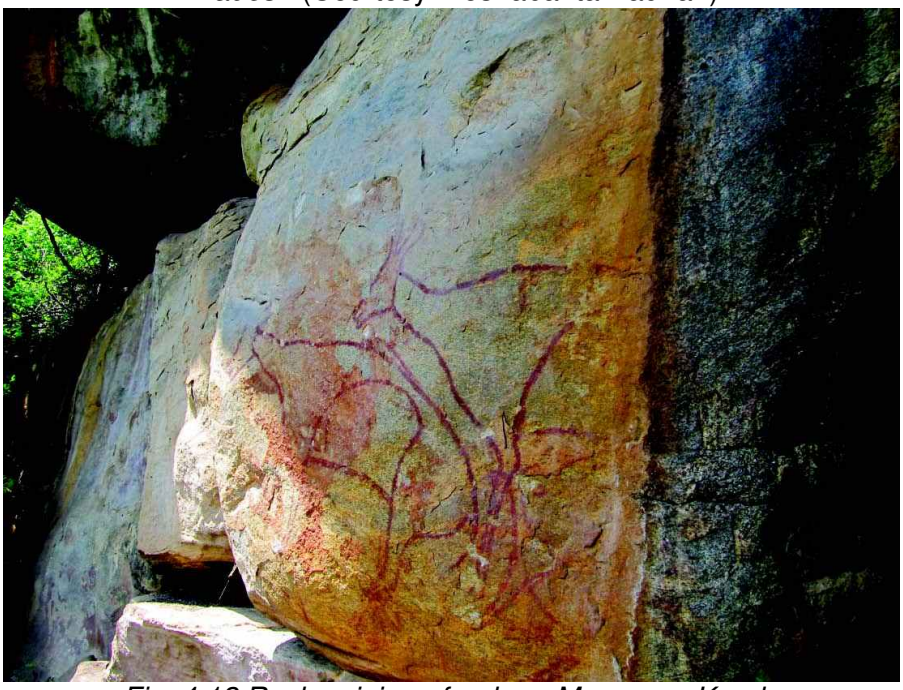

Fig. 4.12 Rock paining of a deer, Marayoor, Kerala

Fig. 4.13 Rock painting depicting a hunting scene, Bhimbetka, Madhya Pradesh (Courtesy: Toshabanta Padhan)

The antiquity of rock paintings has always been a matter of dispute since their initial discovery in India. However, based on the subject matter, technique and superimposition, and above all, based on the confirmed association with radiometrically dated pre-historical cultural remains, attempts have been made to classify those paintings. Such attempts have been made at Bhimbetka. Here we have followed the periodisation worked out by Mathpal (1977: 17-22). Mathpal classified paintings at Bhimbetka into nine phases. Of those nine phases, the paintings of phase 'I' to 'V' have been designated as belonging to the mesolithic phase. The animals depicted in the mesolithic phase include gaur, rhinoceros, elephant, tiger, leopard, bear, boar, sambar, spotted deer, *chinkara*, nilgai, blackbuck, monkey, jackal, fox, dog, porcupine, rat etc. However, sambar dominates the animal world. The size of animals varies from miniature figures of few centimetres to the life size drawings as well as more than life size figures up to four metres in length. Those animals are shown standing, sitting, grazing, moving slowly and running. There are also depictions of mythical animals, showing composite characters. For example, one of the paintings depicts a large animal with an enormous face, like that of a boar and horns of a bull, and its body filled with a wash of colour. (**Fig. 4.14**) The animal has a fierce look and it is chasing a small person, which in turn is running behind a crab (Mathpal 1977: 20). The interesting thing to note is that the same scene is depicted in three different rock shelters. (**Fig. 4.15**) Perhaps, those mythical animals had some symbolic value

or they were held in awe.

Fig. 4.14 Depiction of a mythical animal, Bhimbetka, Madhya Pradesh
(Courtesy: Toshabanta Padhan)

Fig. 4.15 Depiction of a mythical animal, Bhimbetka, Madhya Pradesh
(Courtesy: Toshabanta Padhan)

The hunting scenes depicted at Bhimbetka, other caves and rock shelters show the hunting of a variety of game with spears, bows and arrows, all tipped and barbed with the microliths. The hunters are shown charging and cornering the game, shooting arrows at the prey. They are transporting the kill (to the home base) and butchering. They are fishing by using net traps, trapping of small game: birds, rats and

turtles (Misra 1989: 26). The hunters are depicted hunting singly or in groups, sometimes wearing masks and headdresses, crowned with antlers and horns. Some of the paintings depict unusually large number of animals and men probably representing ceremonial group hunts. The hunters are also sometimes depicted accompanied by dogs. Some of the hunting scenes depicted in those rock-shelters are still common among the aboriginal people of central India, though mainly as a ceremonial activity as wild animals are now scarce and hunting is legally prohibited (Misra 1989: 26).

The Mesolithic Origins of Animal Husbandry

The mesolithic economy, like the Palaeolithic one, was essentially based on the hunting and gathering. For example, as we have seen above, a hunting, gathering and fishing economy is suggested for most of the mesolithic sites of the subcontinent. However, some sites such as Bagor in Rajasthan and Bhimbetka and Adamgarh in Madhya Pradesh have given evidence of domesticated animals. The earlier mesolithic phases at those sites can be dated to around fifth millennium BCE, though the greater antiquity of Adamgarh has been questioned. As we shall see in the next chapter, domesticated cattle and sheep/goats were already present in the region of Baluchistan by the sixth millennium BCE, during the Neolithic period. Therefore, the data from Bagor, Bhimbetka and Adamgarh suggests a far and fast dispersal of livestock amongst some of the Indian mid-Holocene hunter-gatherers (Chattopadhyaya 2002: 407-408). However, Meadow and Patel have particularly questioned the presence of domestic animals at the site of Bagor (Meadow and Patel 2002: 397). Patel further says, '…given the nature and early dating of a site like Bagor and the kinds of locally available wild animals, identification of non-local forms, such as sheep and goats warrant greater than normal caution on the part of the analysts and scepticism on the subsequent users of the data' (Patel 2009: 184). While some objections raised over identification may still need to be resolved, the overall pattern is striking.

Chattopadhyaya's comments in this regard are significant indeed. He says:

> If we accept for a while the high antiquity of the Adamgarh rock-shelter site as a supporting argument for the above claims regarding the rise of animal husbandry during the early Mesolithic period, the combined evidence is indeed interesting. Because of the fact that these sites lie outside the range of the natural habitats of wild sheep and goats, the domestic status of sheep and goat

> from Bagor and Adamgarh may not be doubted. But was domestication invented in this region during the Mesolithic period? The possibility can be ruled out, as there is no evidence for within-site evolution of domestic from wild forms. The natural habitat of the wild progenitors is the distant ranges of the western Himalay. Why and how these wild animals came to plains as far as Rajasthan and Madhya Pradesh in the absence of human protection, remains the question. But we now know for certain that domestication of sheep/goats (as also cattle) had already taken place in the north-western (Mehrgarh) during the sixth millennium BCE. It is likely that pastoral communities of Baluchistan associated with cattle and /or sheep/goats became more widespread during late sixth and fifth millennia and made their influence felt as far as Rajasthan and the uplands of Madhya Pradesh. So rather than explaining animal herding/domestication at Bagor or Adamgarh as a locally developed phenomenon, the wider archaeological evidence may be interpreted as suggesting the presence of a north-west-south-east *mobility axis* of sheep/goat herders and cattle pastoralists. This mobility of populations and their possible diversification in terms of additional specialisation in course of a *cladogenetic* mode of evolution served, in all likelihood, as the initial impetus and necessary basis for the rise and development of various Chalcolithic village settlements (including the Early Harappans), thus cross-cutting this long mobility axis during the intervening period between the Neolithic Mehrgarh and the Bronze Age Harappan Civilization.
>
> *Chattopadhyaya 2002: 407-408.*

Fuller also believes that the pastoralism might have spread amongst hunter-gatherers of the semi-arid scrub or savannah zones during the mid-Holocene period in the subcontinent. He cites examples from the region of Africa to support his arguments, as follows:

> Pastoralism seems to have existed in the absence of agriculture, as evident in the case of parts of Africa. In the early to mid-Holocene Sahara cattle herding may have begun before 7000 BC, at a time when no domesticated plants are known from the region, and sheep-goat and cattle become widespread amongst hunter-forgers across the Sahara and sub-Saharan zone during the mid-Holocene … and even later in Southern Africa (Sadr, 2003). Despite attempts such as that by Wetterstron (1998) to explain this away by positing 'proto-cultivation' of sorghum at Nabta Playa, most of the sites across the Sahara with archaeobotanical evidence indicate grass-seed foraging and limited herding of cattle together with hunting with evidence of plant domesticates and more sedentary sites only

from the third or early second millennium BC.

Fuller 2006: 58.

Recent findings from the site of Loteswar suggest the presence of at least some of the domestic animals in Gujarat by fourth millennium BCE (Patel 2009: 173-188); also see chapter 4). Recent dates obtained at the chalcolithic site of Balathal have suggested that the chalcolithic occupation at the site began at *c.* 3700 BCE or earlier (Misra 2005: 54-60). The faunal remains identified at the site have revealed the presence of all the domestic animals (see Chapter 4). This growing body of evidence is providing potentially exciting insights into the economic transitions in the Indian subcontinent. Future researches in the regions of Gujarat and Rajasthan will certainly throw more light on the phenomenon.

Emerging Picture

As we have seen above, the Indian Palaeolithic cultures are characterised by the paucity of faunal remains in proper stratified contexts. Owing to that paucity of organic remains at most sites, scholars have attempted to study modern hunter-gatherers as keys to gaining an understanding of prehistoric subsistence. However, apart from highlighting continuity in the exploitation of ecological zones and use of similar resources from the lower Palaeolithic onwards, ethnographic studies have not produced any model of past behaviour. Nevertheless, the Palaeolithic cultures can essentially be characterised as the hunter-gatherers, who depended on the natural resources for their subsistence and lived off the plants and animals available around them (Pappu 2004: 129-142).

By the end of upper Palaeolithic, however, changing climatic conditions and growing populations put a strain on the traditional hunter-gatherer lifestyles. Favourable climatic conditions gradually led to an intensification of the use of resources such as food and shelter and to the development of an increasingly diverse array of technologies to cope with the provisioning of resources. Now, societies were not only becoming larger, but were also using up the local plant and animal resources more quickly. Those trends represent the advent of mesolithic economies, the next stage of human cultures. One result of that was an adaptation to food resources that could be replenished more quickly than previous resources. Now people were shifting to hunting of more plentiful animals that also reproduced quickly, such as rabbits, deer, antelopes, fish and shellfish. That adaptation also included a shift toward plentiful plants foods such as grains and nuts.

Recent ethnographic studies on hunter-gatherers have shown that hunter-gatherers fully and actively engage in the modern world. It has been realised now that hunting behaviour does not essentially exclude other modes of behaviour. They trade with farmers, participate in wage labour and sometimes practice farming. Although these new perceptions present some complications for anthropologists to explain change in past hunter-gatherer subsistence practices, these perspectives also opened up new possibilities.

Fox’s review of existed literature of five hunting-and-gathering groups revealed that the ethnographic parallels of Indian hunter-gatherers might be helpful for understanding prehistoric exchange between

agricultural communities and rural nomads. According to him ‘Indian hunters and gatherers represent occupationally specialized units and their economic regimen is geared to trade and exchange with the more complex agricultural communities within whose orbit they live’ (Fox 1969: 141). On the same lines, Morrison argued that forgers and traders may be thought as economic and cultural specialists in so far as many of the products they gather and trade are not food stuffs and indeed are not used by them at all except as a mediums of exchange (Morrison 2007: 321-339). When the hunter-gatherers are seen as actively participating in the social world, change in hunting-and-gathering can be seen as a response to the cultural milieu. R. L. Bauer, who worked on the faunal remains recovered from Iron Age sites in southern India for her Ph. D. dissertation, says, ‘It is important to consider the relationship between farmed, gathered, hunted and reared food items; as a social and solitary behaviour, hunting provides a different contribution to both social and subsistence needs, and involves different strategies and cultural logic.’

5.

Early Farming Cultures

WITH THE NEOLITHIC PERIOD, WE ENTER INTO THE FINAL STAGE OF stone age that sets the ground for the emergence of later civilisations. The word 'Neolithic' was first coined by Sir John Lubbock in his *Prehistoric Times,* first published in CE 1865. Although his emphasis was on technological changes rather than economic ones, yet the sedentary way of life—pottery, agriculture and animal husbandry—came to be seen as intricately connected with it at some point. For V. Gordon Childe (1944: 7-24), the neolithic stage was a revolutionary change in human prehistory. That neolithic 'Revolution' is generally seen as a period of sudden and profound cultural change that occurred independently in different places across the globe. The material culture recovered from neolithic sites points to a profound change from the preceding mesolithic in the socio-economy, and suggests the emergence of a more settled lifestyle.

While the Neolithic age is generally associated with the food production, pottery and a sedentary way of life, in reality it is not so; it is multifaceted. In India, as in other parts of the world, various traits of the Neolithic did not evolve simultaneously. The roots of some of the traits, normally connected with the Neolithic, can be traced to the earlier Mesolithic phase. For instance, as we have seen in the last chapter, some of the mesolithic sites have revealed the evidence of ceramics, as can be seen in the mesolithic sites of Vindhyan region. Likewise, there were references to the evidence of domestic animals in certain mesolithic sites. Then again, there are phases like aceramic neolithic (all features minus pottery). The subject of the sedentary way of life is also complex. In addition, the Neolithic is generally marked by the use of ground stone tools and scholars have traditionally placed more importance on the presence or absence of such artefacts than on the evidence of domestication of plants and animals. In fact, 'microliths', a characteristic feature of the mesolithic sites, can also be seen in the neolithic sites, and some scholars even define the mesolithic sites as the proto-neolithic. Consequently, the processes of culture change and the developmental stages and/or transformation from one cultural stage to another reflecting in the material milieu, are under the scanner.

Other important point to note is that while there are some pure neolithic sites, there are many more neolithic-chalcolithic sites, which not only reveal the elements of neolithic culture, but also the use of metal (mainly copper). (**Fig. 5.1**) Recent research has begun to elucidate the order and interrelationship of those changes. Furthermore, there is little evidence of either a neolithic or a neolithic-chalcolithic stage in some parts of the subcontinent. In such regions, the earliest sedentary communities appear in a full-fledged chalcolithic context. Those chalcolithic communities are marked by their distinctive ceramic assemblage, a specialised microlithic industry, limited use of copper, and subsistence based on the farming, raising stock and hunting. Those communities were all regional and rural in character, perhaps determined by their respective ecological niches. Many of those chalcolithic cultures were partly contemporary to the 'early-Indus', 'mature-Indus' or 'late-Indus'. In fact, those chalcolithic cultures can be called early farmers in their respective areas, as their subsistence pattern and tool technologies are analogues.

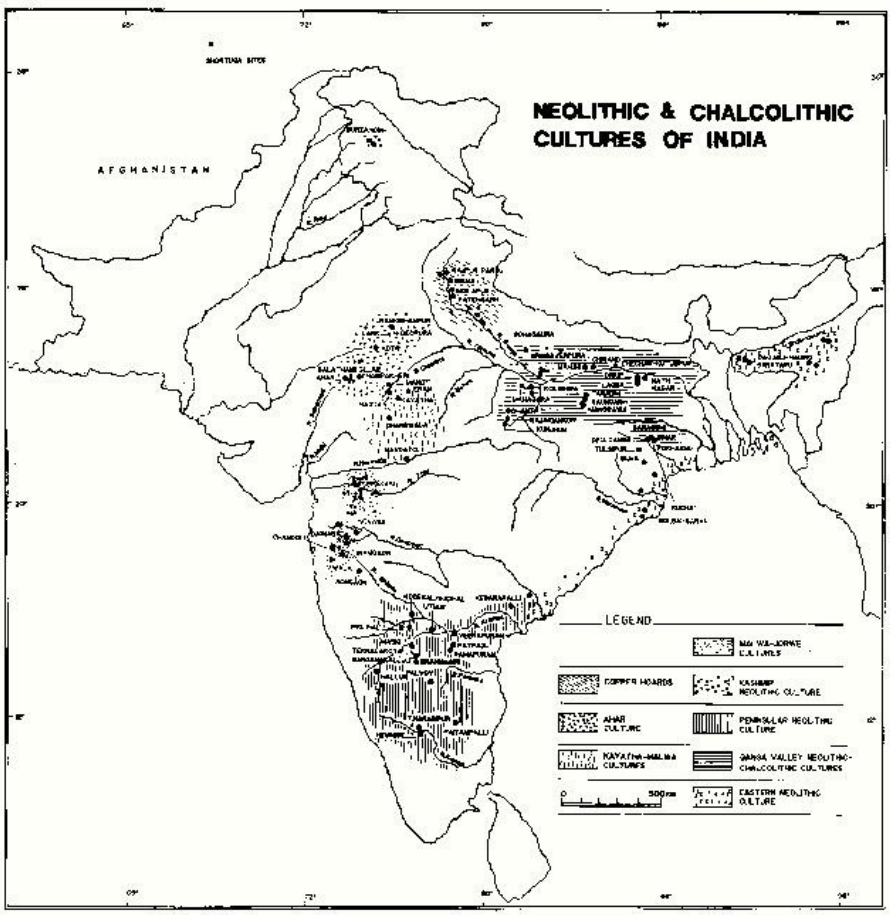

Fig. 5.1 Map showing Neolithic and Chalcolithic sites (Misra 2001)

The domestication of plants and animals did not mean the end of the huntingand-gathering way of life. The communities that practiced animal rearing and agriculture usually continued to hunt wild animals for food. In addition, there were many communities, which never switched over to domestication, but retained their huntingand-gathering way of life. However, this chapter is not on those communities, but about those, which made change.

The Neolithic Traditions

The neolithic cultures have a comparatively restricted distribution in the subcontinent, being confined to Kashmir Valley, the northern Vindhyas, middle Ganga Valley, and the eastern, northeastern and southern India. With respect to technology, the main component in the neolithic cultures comprised the ground polished stone tools. The architecture appears to be simple, consisting mainly of wattle and daub circular or rectangular huts. The neolithic cultures of India have been defined into several regions by various scholars and there is disagreement in the classification of the neolithic sites. However, considering the most recent data on the subject, the Neolithic of India, for the present discussion, has been divided into five regional traditions: (1) the Mehrgarh Neolithic, (2) the Northern Neolithic, (3) the Neolithic-Chalcolithic of the Ganga Valley and the Vindhyas, (4) the Eastern Neolithic, and (5) the Southern Neolithic.

The Mehrgarh Neolithic

By the mid-sixth or the early fifth millennium BCE, there were a number of farming settlements in Baluchistan. Those settlements included Kili Ghul Mohammad, Anjira, Siah Damb, Rana Ghundai and Mehrgarh 'Period II', among others. Among those, the site of Mehrgarh provides the most comprehensive information on that period. It provides the best-documented evidence on the beginning of animal husbandry and its subsequent development in the Indian subcontinent. The site was excavated by the French Archaeological Mission, headed by Jean-Francois Jarrige, for over 11 seasons. Their extensive work yielded valuable information about early agriculture and animal husbandry.

The site is located in the Bolan basin, in the northwestern part of Kachi-Bolan Plain, a great alluvial expanse that merges with the Indus Valley. That prehistoric settlement covers an area of more than 200 ha, making it one of the largest settlements of neolithic culture between the Indus and Mediterranean. Excavations at the site revealed seven cultural periods. Of those, the first two periods are considered as Neolithic: 'Period I' (aceramic Neolithic) and 'Period II' (ceramic Neolithic). The remains of 'Period I' are further sub-divided into 'Period IA', 'Period IB' and 'Period IC'.

The faunal remains recovered from period IA (aceramic Neolithic dated

to early seventh or late eighth millennium BCE) revealed the presence 12 wild animals that included gazelle, wild sheep, wild goat, wild ass, blackbuck, nilgai, large deer, small deer, wild boar, wild water buffalo, wild cattle and most probably elephant (Meadow 1996: 402-403). Gazelle remains occurred most frequently and constituted 42 percent of the faunal assemblage of that period. In addition to those wild animals, the remains of two domesticates, goat and cattle, have been reported from that period. Based on their much smaller size, those have been distinguished from their wild relatives. A few remains of carnivores, birds, fish, and turtle also made their presence felt in the assemblage and apparently, little use of those animals was made. On the meagre presence of those animals, Chattopadhyaya says, 'This is somewhat strange and has to be understood perhaps in the light of taphonomic factors affecting the survival of smaller bones' Chattopadhyaya (2002: 383). However, Meadow comments that the wild sheep, goat, cattle and buffalo, recovered from that phase, all comprised potential ancestral stock for the domestic forms. The offering of infant goats in a number of burials led him to believe that goats were likely to have been domesticated even at the beginning of 'Period I' (Meadow 1981: 143-179).

In the subsequent periods of aceramic Neolithic (IB and IC), a substantial decrease in the remains of gazelle has been noticed. On the other hand, the remains of sheep and cattle come to dominate increasingly the faunal assemblages of successive strata. In addition, the animals represented also grew smaller (Meadow 1989b: 167-175). That significant decrease in the remains of gazelle and increase in the bones of sheep and cattle shows that people started to concentrate more and more on potential domesticates. By the end of aceramic Neolithic (*c.* 5500 BCE), a majority of animals present in the assemblage were of domestic types, like sheep, goat and cattle. The gazelle disappears in 'Period II' (ceramic Neolithic), only to reappear in the subsequent periods, though in very small quantities. The remains of cattle, on the other hand, constituted about 65 percent of the assemblage by the middle of 'Period II' (*c.* 5000 BCE). However, that high percentage of cattle was never noticed in the subsequent periods at the site. That decrease in the representation of cattle in the later periods, according to Meadow, reflects house cleaning activities. He says:

> I have noted that the cattle bones that occur in such high proportions especially during the ceramic Neolithic (Periods IB, IIA, IIB) come from trash deposits in and around compartmented buildings that were probably used for storage. While such 'cell-units' structures have been found in Periods IB through III at

> Mehrgarh, none have been identified from later periods IV-VIIC during which time the architecture appears to be more 'domestic' in character with doorways and hearths in some of the rooms and courtyards.
>
> *Meadow 1989b: 167.*

By the beginning of 'Period III' (Chalcolithic period: *c*. 4500 BCE), the size diminution in all the animals had largely ended. Regarding the animal-based subsistence economy of early Mehrgarh, he observes:

> Zebu cattle (*Bos indicus*), sheep (*Ovis aries*), and even goats (*Capra hircus*) may have been domesticated locally starting perhaps as early as the end of the eight millennium BCE. The domestication process would have been largely completed by the mid-sixth millennium BCE (ceramic Neolithic period IIA) if not somewhat earlier (early ceramic Neolithic period IB). The development of animal keeping by the ancient inhabitants of Mehrgarh took place in the context of cereal crop cultivation, the building of substantial mud brick structures, and the existence of social differentiation and long distance trade networks as attested by the presence of marine shells, lapis lazuli and turquoise in even the earliest graves.
>
> *Meadow 1989b: 167.*

The above evidence shows that there is clear evidence of local domestication of at least cattle and sheep at the site of Mehrgarh. The evidence of cattle, in particular, clearly indicated domestication of local wild stock. That also could be the case with sheep. Meadow attributes the cattle to *Bos indicus* and the wild progenitor to *Bos nomadicus* (a Pleistocene and later fossil species of the Iranian plateau and elsewhere in South Asia).

To begin with, the sheep, goat and cattle were wild, though there were some domestic goats since the earliest phase. Over time, those potential domesticates come to look like domesticated animals, showing a smaller size and other typical osteological features of domestication. Additionally, those animals also come to dominate the faunal assemblage in the successive phases. The percentage of cattle alone changes from four to 38 to 65 by *ca*. 5000 BCE (Meadow 1989b: 167-175). The archaeological evidence of cattle domestication at Mehrgarh is also supported by phylogenetic evidence. As stated in Chapter 3, recent genetic data suggests that there were multiple domestication events of *Bos indicus* in different part of South Asia. The situation with sheep, however, is not straightforward. Recent genetic evidence indicates that domestic sheep was derived from Asiatic

mouflon and the site of Mehrgarh does not lie within the present range of this species. That implies that either the Holocene geography of wild sheep was very different or the sheep from the west later replaced the original domestic sheep of Baluchistan (Meadow 1996: 390-412).

A parallel and integrated process of the domestication of barley, if not of wheat, also accompanied the process of animal domestication at Mehrgarh in the subcontinent. A number of charred cottonseeds identified at the site suggest either cotton cultivation or the use of wild cotton plant.

The Northern Neolithic

A neolithic tradition has been documented in Kashmir and the far north of Pakistan in the Swat Valley. Generally known as the 'Northern Neolithic', that tradition is best represented by a large number of sites in the Kashmir Valley, although the related sites can be identified in the northwest region of Pakistan. The Neolithic of the Kashmir Valley show a long and well-rooted adjustment with the geographical setting of the valley. The neolithic settlers here occupied the commanding terraces of the *karewas* (raised plateau-like formations with the slopping sides separated by ravines), the remnants of Pleistocene lakebeds. Geological studies of the fossil remains of aquatic animals and plants also confirm that the valley was once submerged in the vast lake. During the Holocene period, significant changes took place in the valley, both in terms of culture and subsistence activities, as new people settled in the valley with new equipment and technology to cope with the changing climatic conditions of the new age. That new story of transformation was what we know as the neolithic culture.

The knowledge about the neolithic culture in Kashmir is largely based on the excavations at Burzahom, Gufkral and Kanishkapura, though a number of neolithic settlements in Kashmir Valley are still to be excavated. The new evidence of radiocarbon dates from Kanishkapura suggests the beginning of the Neolithic age in Kashmir in the latter half of the fourth millennium BCE as an aceramic phase (Mani 2004: 139). The radiocarbon evidence from the neolithic sites of Kashmir suggests that the neolithic tradition entered the Kashmir Valley in the second half of fourth millennium BCE, when the neolithic settlers occupied western part of the valley and then moved towards central Kashmir, as the dates from Burzahom indicate the occupation around 2881 BCE onwards (Mani 2004: 139). Based on the evidence at the site of Gufkral, he further suggested the movement of neolithic settlements towards the southeastern part of Kashmir in about 2347 BCE

The faunal remains from the excavated sites at Burzahom and Gufkral have been studied. The site of Burzahom revealed a three-fold cultural sequence beginning with the neolithic, followed by the megalithic and the historical. The neolithic phase was further sub-divided into neolithic 'Phase I' (aceramic) and neolithic 'Phase II' (ceramic). Broad and deep pits characterise the earliest phase of neolithic at that site. Those pits have generally been interpreted as 'pit houses', but that has been questioned by the recent researches. It is held that those pits were used as grain stores and the northern neolithic was a transhumant or semi-sedentary culture instead of a fully sedentary one (Conningham and Sutherland 1997: 29-34). Those pits were filled, rammed and sprinkled with red ochre and used as floor for mud-brick houses in the successive neolithic phase. Nath's analysis of the faunal remains from the Neolithic period at that site revealed the presence of both domestic animals (cattle, buffalo, sheep, goat, pig and dog) and wild animals (*barasingha*, Kashmir stag, sambar, nilgai and wild boar) (Nath 1969: 102-110).

Excavations at Burzahom also furnished interesting data regarding the burial practices prevalent in the neolithic 'Phase II'. Those burials were recovered within the settlement areas. The interesting aspect of those burial practices was the custom of burying animals also. However, it seems that the custom of burying animals was just taking shape in that phase, but that became a regular practice in later phases (Sharma 1998: 88-116). It appears that dog (both domestic and wild), stag and goat were sacrificed during the disposal of human body, and some part of one or more of those animals were buried along with the human body only in the same pit. One of the burials in 'Phase II' revealed fragmentary bones of wild dogs along with two antlers of *barasingha*. The dogs were represented by five intact skulls, to which were attached portions of the vertebral columns in articulated conditions. Sharma states that from the condition of bones, it appears that dogs were sacrificed, stripped of their flesh and ceremonially buried (Sharma 1998: 90). According to some scholars, the practice of burying dogs with their masters is a characteristic trait of the north Chinese neolithic Culture.

As was the case with Burzahom, excavations at Gufkral also revealed three periods: the neolithic, the megalithic and the early historical. Based on the pottery, the excavator further divided the neolithic period into three sub-phases as: (1) Aceramic Neolithic, (2) early Neolithic, and (3) late Neolithic. Sharma has identified a wide range of species (both domestic and wild) from those different phases of the Neolithic period. The animal remains recovered from the 'aceramic neolithic phase' demonstrated that people of that period were predominantly

dependent on the wild animals that included wild sheep, wild goat, wild cattle, red deer, wolf, Himalayan ibex, Himalayan *thar*, serow and bear. In addition to those, a small percentage of domestic animals, such as domestic goat (three percent) and sheep (five percent) have also been identified from that period (Sharma 1998: 15-20). He mentions a sudden spurt of domestic animals like sheep (14 percent), goat (12 percent) and cattle (18 percent) in the subsequent early neolithic period. Other animals of that period included wild sheep, wild goat, wild cattle, dog, wolf, domestic fowl, red deer, ibex and bear. The late neolithic period revealed a further increase in the proportion of the domestic animals as, sheep (25 percent), goat (20 percent) and cattle (24 percent). Dog, red deer, ibex, wild boar, hare, hedgehog, beaver, rodents and fish also made their presence felt in the assemblage during that phase. Sharma states that the bones of sheep and goat not only dominated the assemblage during that phase, but there was also a considerable decrease in the sizes of those animals. He also observed that during the aceramic neolithic phase, the animals killed were of all ages and sexes, indicating an assemblage of purely hunted animals (Sharma 1998: 17-19). On the other hand, from the early Neolithic onwards the kill consisted of young animals, with a predominance of male, suggesting the practice of herding.

Hunting was clearly one of the favourite occupations of the neolithic people of Kashmir, as evidenced by the remains of various wild animals, various tools and a hunting scene depicted on one of the two engraved stone slabs, found fixed in a rectangular structure facing downwards at Burzahom. That stone slab depicts a scene in which a stag with antlers is being attacked from both the rear and front. The hunter from the rear is attacking the animal with a long spear while his counterpart in the front is attacking with an arrow. The upper portion of the slab depicts two circles with emanating rays and a dog-like animal. (**Fig. 5.2**)

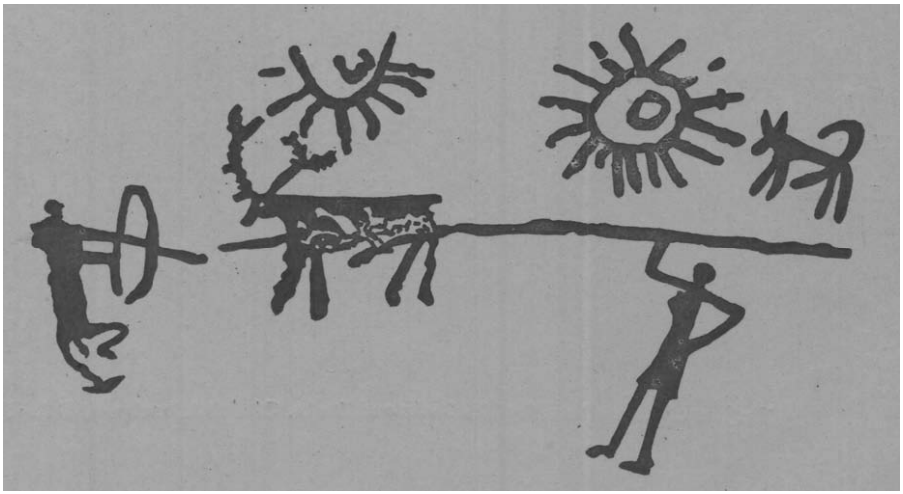

Fig. 5.2 Stone slab from Burzahom depicting a hunting scene (From cover of Man and Environment, *Volume X, 1986)*

The neolithic sites of Burzahom and Gufkral also revealed a good number of bone-made artefacts. At Burzahom, the main bone tool types were harpoons, needles with or without eye, awl, spear points, arrowheads, scrapers and daggers. Some of those tools were made of antlers. A cobbler's poker-like borer of a long hollow bone, a unique composite tool, has also been recovered from the site (Kaw 1979: 224). The presence of about 2000 bone tools indicates the existence of a bone tool industry at the site. Tools recovered from the site of Gufkral include arrowheads, awls, pierces, scrapers, harpoons, spatula and a needle-with-eye. While some tools were fully polished, some were polished only at the working tips, such as arrowheads. According to him, bones of sheep, goat, cervus and ibex seemed to be preferred material for making those tools. Arrowheads were not only tiny in size like the microliths, but their tips were also charred.

In the Swat Valley, the evidence of the Neolithic comes from the sites at Loebanr and Aligrama, which can be dated to the first half of the second millennium BCE. Those two sites appear to be settled at the same time. The presence of underground dwelling pits and the bone objects at Loebnar III may be similar to the neolithic culture of Kashmir. Compagnoni (1987: 131-153) analysed the faunal remains recovered from those sites and revealed the presence of both domestic and wild animals, which indicates a broad similarity with the ones identified in the Kashmir Valley (Compagnoni 1987: 131-153). Domestic animals identified from those sites include cattle, sheep, goat, pig, horse, donkey and dog. Besides, the remains of water buffalo and camel have also been reported from the site of Loebanr only. The presence of horse, donkey and camel in those sites suggests a long distance

movement of people or goods between the Swat Valley and other regions during the first half of second millennium BCE (Chattopadhyaya 2002: 386). The wild animals identified at those sites include markhor, goral, deer, wild boar, an unidentified equid species, tiger *(Panthera tigris)*, wild cat, porcupine and hare. One important feature of the faunal assemblage at Aligrama was the presence of skeletons of complete sheep and ass recovered from 'Period V'. The higher frequency of the bones of cattle at those sites suggests that cattle were not only used for meat, but probably also for the secondary products. Because of the small number of wild animals at those sites, Compagnoni remarks that hunting was probably not a regular but occasional profession (Compagnoni 1987: 131-153).

Neolithic-Chalcolithic Cultures of Ganga Valley and the Vindhyas

The neolithic culture of the Vindhyas and the Ganga Valley is generally succeeded by the chalcolithic culture. Therefore, both have been dealt here together. The neolithic and chalcolithic cultural phases in the Vindhyas and the Ganga Valley are crucial to our understanding of the animal-human interactions and the emergence of animal husbandry. Those interactions are dependent on complex phenomena, such as migration of people with their domestic animals, exchange networks involving animals and other goods, and interdependence of hunter-gatherer and settled agro-pastoral communities. However, incomplete archaeological record prevents one from attempting fine level interpretations. Nevertheless, the picture of Ganga Valley excavations in recent years is not too bad as at many sites in this region, the faunal material has been meticulously collected and handed over to the specialists, but the information is not complete in all the cases.

Systematic explorations and excavations carried out by the Department of Ancient History, Culture, and Archaeology of University of Allahabad in the Belan and Son valleys, have brought to light some very interesting evidence of the neolithic culture of that region. The work that it did not only documented sites ranging from the upper Palaeolithic to the Neolithic period with abundant artefacts, but also presented interesting evidence for human-animal interactions and some of the world's earliest agricultural activity, including the first known rice cultivation. The neolithic sites of Koldihwa and Mahagara are the important ones from this region, which have furnished evidence of a distinct neolithic tradition. Those sites are situated on either bank of the River Belan. While those sites have revealed the existence of a neolithic economy, an earlier phase, termed as 'advanced mesolithic',

has been identified at the site called Chopani Mando (see Chapter 4). Alur's study of faunal remains recovered from those sites revealed the presence of cattle, sheep, goat, horse, deer, wild boar, tortoise and fish. Of those, the remains of horse and wild boar have been identified at the site of Mahagara alone. In addition, based on the size differences of cattle bones, he argued for the emergence of cattle husbandry practices at those sites(Alur 1980: 201-230).

Later on, Chattopadhyaya carried out a detailed study of those two faunal assemblages for his doctoral work, which established presence of some of the species that Alur had identified as cattle, sheep/goat, tortoise, and fish. However, Chattopadhyaya's study did not confirm the presence of horse at Mahagara. In addition, he reported the presence blackbuck, porcupine, wolf, (possibly) dog, and molluscan shells at the site of Mahagara. Additional species identified at both sites include spotted deer, *barasingha*, chicken and rat. Chattopadhyaya also carried out a detailed metrical analysis of the cattle bones. Based on the results of that analysis, he argued that the size differences among cattle bones noted by Alur on cattle bones may at best be explained in terms of sexual dimorphism within the same species, and that cannot be taken as evidence to support the emergence of cattle husbandry practices at those sites. He asserts:

> If domestication had been a local development in this region during the Neolithic times, Alur's method based on osteomorphological criteria and size variation (without recourse to metrical analysis) could not convincingly establish any 'gradual' change in cattle osteomorphology from the Upper Palaeolithic through to the Neolithic in this region.
>
> *Chattopadhyaya 2002: 388.*

The excavations at the Mahagara site have also thrown light on a cattle-pen. That cattle pen (measuring 12.5 × 7.5 m) appears to have been fenced by 20 post-holes with wider spaces left for the opening, of which two on the eastern and one on the western side can be surmised (Thapar 1987: 250). Within the fenced area, no pottery or other finds were found. On the other hand, a large number of the clustered hoof impressions of cattle of different ages ere recorded, which indicates that the cattle pen accommodated about 40 to 60 animals (Thapar 1987: 250). (**Fig. 5.3**) In the absence of evidence, it can be presumed that the cattle were left untied in the pen. In addition to those cattle hoof marks, hoof marks of sheep and goats have also been noticed outside the cattle pen near a hut cluster. The occurrence of those hoof marks almost in a straight line suggests the movement of animals. The planning of huts around the cattle pen reflects keen

awareness of the neolithic people to provide protection to their domesticated animals.

Fig. 5.3 Hoof impression of a goat, Mahagara (Courtesy: J. N. Pal)

That evidence from the neolithic Vindhyas indicated a mixed focal economy based on the cattle husbandry and incipient rice husbandry. Recent excavations conducted at the neolithic sites of Jhusi and Lahuradeva indicate human occupation in the sixth millennium BCE. The site of Lahuradeva, in particular, has provided some valuable evidence relating to that. The site of Lahuradeva is located in district Sant Kabirnagar, Uttar Pradesh. The excavations at this site revealed a five-fold cultural sequence. The culture related to 'Period I' (*ca.* seventh – second millennium BCE) has been designated as the early farming phase. That phase was represented by the cord-impressed pottery. That period is further divided into two sub-periods based on the nature of deposits, cultural material and radiocarbon dates: 'Period IA' (seventh millennium BCE to the beginning of the third millennium BCE) and 'Period IB' (third to second millennium BCE). Evidence from sub-period 'IA' revealed that the settlers of that period built circular or

oval huts using wooden posts and having reed-screens plastered with clay. Handmade coarse variety of red and black-and-red ware (often with cord impressions on the exterior surface) were the characteristic ceramics of that sub-period. The presence of carbonised grains of wild or weedy domesticated rice was the most important finding of that period. AMS dates from a husk-clot of domesticated rice from that period revealed the date of 6409 BCE (Tewari et al. 2007-08: 347-373). That establishes the presence of fully domesticated rice by at least the mid-seventh millennium BCE. Tewari studied the faunal remains that consisted mostly of small fragments of bones from sub-period 'IA'. The animals identified from that included wild animals and a few non-mammalian species. Wild animals utilised for food were the gaur, sambar, spotted deer, wild pig, porcupine, mongoose, hare, common squirrel and birds. Fish formed a considerable proportion of the subsistence activity of that period.

Sub-period 'IB' is marked by the introduction of bowl or dish-on-stand. Grains of barley, wheat and lentil were also found in addition to the rice. Presence of the postholes and burnt mud-clots with reed-marks in that sub-period indicates that the earlier tradition of wattle-and-daub dwelling of sub-period 'IA' continued. As compared to sub-period 'IA', the faunal remains recovered from sub-period 'IB' revealed more diversity. The use of wild animals, such as gaur, sambar, spotted deer and wild pig continued. Small animals, such as mongoose, hare, and common squirrel continued to be hunted or trapped for food. However, the important feature of sub-period 'IB'was the addition of domestic goats, but the bones of that animal were limited in number. One fragment of buffalo bone was also recovered from that period, but it is not clear whether that bone belonged to the wild or domestic buffalo. One of the interesting findings of that period was the presence of panther; its bone suggests that its meat might have been consumed. That period also has evidence of the bandicoot rat, the species that survives along with humans, if enough food is available throughout the year. Non-mammals, such as birds, reptiles and fishes continued to be used as during the previous period. That site also revealed the presence of a copper fishhook during this sub-period

Reports dealing with the faunal remains recovered from the neolithic and chalcolithic phases at the sites of Tokwa, Jhusi and Pakkakot have recently been published. The faunal material from the neolithic phase at Tokwa showed the presence of two domestic mammalian species (cattle and goat), wild mammals (gaur, deer, antelopes and porcupine), bird, fish and molluscan shells. Both domestic and wild animals have also been reported from Jhusi. Domestic mammals formed a major component of the faunal assemblage. Another feature

of those sites is the presence a limited number of bone and antler tools. (**Fig. 5.4**) (**Fig. 5.5**) (**Fig. 5.6**)

Fig. 5.4 Antler tools from Pakkakot, Uttar Pradesh

Fig. 5.5 Antler tool from Pakkakot, Uttar Pradesh

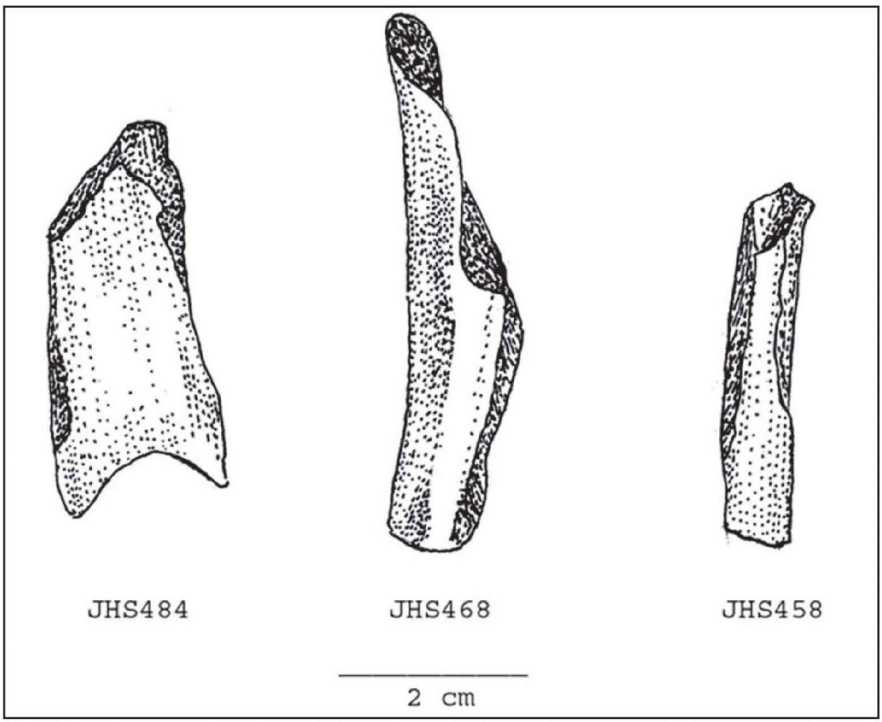

Fig. 5.6 Bone tools from Jhusi, Uttar Pradesh

Although some constraints do exist, yet the archaeo-faunal record of the Ganga Valley and the Vindhyan sites from the Mesolithic Age onwards is steadily increasing, allowing one to visualise subsistence-related activities in the past. The faunal use pattern for the domestic and wild mammals in the neolithic and chalcolithic periods was more or less the same. The domestic fauna appears at Lahuradeva 'IB', Koldihwa and Mahagara in the neolithic contexts. However, no site so far is available to demonstrate within-site domestication process. The number of sites so far known in the Ganga Valley and the adjacent Vindhyan region is impressive. A complex network, involving

connections at various community levels, might have existed, resulting in human-assisted movements in the past.

The Eastern Neolithic

The eastern neolithic tradition covers a vast area from Bihar, Odisha (Orissa) and West Bengal to Assam. Given the vast area of distribution, many scholars have tried to classify this huge area into distinctive groups. For example, Thapar divides the eastern neolithic into three sub-zones: (1) northeastern (covering Assam and sub-Himalayan region), (2) mid-eastern (northern Bihar), and (3) central-eastern (covering Chotanagpur plateau, Odisha and West Bengal). Likewise, Singh divides this region into four sub-zones: (1) the Kaimur Hills and the Chotanagpur plateau, (2) the mid-eastern region (covering the northern Bihar district of Saran), (3) the central-eastern region (Bengal, Bihar and Odisha complex) and, (4) the northeastern region (Assam complex) (Thapar 1987: 247-254; Singh 2002: 127-150). It shows that no two scholars agree on one classification. However, for the present, it is thought appropriate to discuss all those sub-zones together under the heading of the eastern neolithic.

The neolithic remains in Bihar have been reported from three main geographical zones: the riverine plains to the north of Ganga (Chirand and Chechar-Kutubpur), the foothills of the northern flanks of the Kaimur ranges (Senuwar, Sasaram, Taradih and Gaya districts) and the hilly regions of south Bihar. However, the sites of Chirand and Senuwar have produced an appreciable quantity of faunal remains in the whole of Bihar, and these two sites have furnished the data that give some idea about the socioeconomic conditions of the neolithic-chalcolithic peoples in Bihar. Therefore, both sites are discussed in detail.

The site of Chirand is located on the left bank of River Ghaghra in Saran district of north Bihar. The site revealed the material inventory of three distinct cultural periods: (1) ‘Period I’ (the neolithic), (2) ‘Period II’ (the chalcolithic), and (3) ‘Period III’, characterised by the appearance of iron. The beginning of neolithic period at that site can be dated to around the late third millennium BCE based on the radiocarbon dates. Nath and Biswas have studied the skeletal remains recovered from that site, which revealed 11 mammalian species from the neolithic phase. Those species include both domestic mammals (cattle, buffalo, sheep, goat, pig, and dog) and wild mammals (*chital*, swamp deer, wild boar, elephant and rhino). In addition, turtles, birds, fish, snails and shells have also been identified from the site (Nath and Biswas 1980: 115124). The inhabitants of that site also appear to cultivated rice,

wheat, barley and lentil, such as *moong*, *masur* and pea (Singh 2002: 138). This data suggests that Chirand was occupied by a small-scale agricultural community, associated with animal husbandry, hunting and fishing. However, hunting and fishing played an important part in the lives of people, as is evident from the large number of bones of wild animals, birds and the clusters of fish scales.

The site of Chirand also brought to light the evidence of a highly sophisticated bone tool and object industry. The site not only revealed a good number of finished bone artefacts, but also bones in various stages of manufacture. The bone and antler tools of Chirand are no less than 400 in number and those can be considered as the replicas of stone prototypes. The bone tools include pick, burnisher, chisel, hammer, digger, weeder, bar-celt, shaft-straightener, side-scraper, end-scraper, needle, bodkin, toothpick, awl, arrowhead, spear point, disc, socket and adze. In addition, the site also revealed the evidence of other bone objects, like a surveying instrument, compass, bangles, combs and pendants (Naraian 1972: 1-24). Furthermore, Verma reported the shoulder bone of an ox that which might have been used as a shovel (Verma 1970-71: 19). Those tools were fashioned from limb bones of large ungulates as well as from antlers. Additionally, some tools were also made from turtle plastrons.

Narain (1972: 1-24) discussed the methods of bone tool making at Chirand that included boiling of the bones beforehand to provide durability and hardness (Narain 1972: 1-24). That was comparable to the controlled heating of bones in the mesolithic sites of Ganga Valley (Chattopadhyaya 2002: 389). He states that the availability of earthen vessels was probably the main reason of heating bones at the neolithic Chirand. The excavation at the site has thrown light on a hut with a number of oblong ovens (Verma 1970-71: 22). That might have also been used for the large-scale manufacturing of bone artefacts (Chattopadhyaya 2002: 381). He also suggests,'...these tools were not meant for local use alone and there is a great degree of probability that these items had a wide range of distribution in order to negotiate the exchange of other items of use from surrounding areas' (Chattopadhyaya 2002: 389). It is important that such a large variety of bone and antler tools have not been reported from any other neolithic site, except Burzahom. However, at Burzahom the tool typology is different.

The site of Senuwar is located on the right bank of the River Kudra in Rohtas district of Bihar. The excavations at the site yielded evidence of four successive cultural periods: 'Period IA' (the neolithic), 'Period IB' (the neolithic-chalcolithic), 'Period II' (the chalcolithic) and 'Period III'

(NBP and Kushan). Radiocarbon dates obtained from the earliest levels of the neolithic-chalcolithic period suggest 1800 BCE as the beginning of that cultural period. The beginning of the neolithic at the site may be dated to around in the beginning of the third millennium BCE. The faunal remains recovered from the site have been studied by Sathe and Badam, which revealed that cattle, buffalo, sheep, goat and domestic pig were the major domestic animals during the neolithic, neolithic-chalcolithic and chalcolithic periods at the site. In addition, the dog has also been reported from the neolithic period. The wild animals found at that site were wolf, nilgai, blackbuck, *chital*, barking deer and four-horned antelope. The consumption of beef was always more that 40 percent in different periods, as (neolithic 57 percent, neolithic-chalcolithic 45 percent and chalcolithic 55 percent) of all the meat obtained from the domestic and wild animals (Sathe and Badam 1996: 43-48). However, buffalo appeared to have been consumed in equal proportion during the neolithic-chalcolithic period. It seems that sheep and goat played a secondary role in the subsistence economy. The inhabitants also used bone as raw material for making various types of finished tools, comprising chisels of different shapes and sizes, borer, points and so on. The bone tools, particularly of the neolithic-chalcolithic period at Senuwar, closely resemble to those obtained from the site of Chirand (Sathe and Badam 1996: 48).

With respect to bio-archaeological datasets, the region of Odisha is poorly studied. The neolithic sites are widely distributed in Odisha, and the lack of systematic sampling and recording of animal bones in such area precludes one to make definitive statements about the neolithic animal husbandry. However, some preliminary observations by way of a working hypothesis can be made about those neolithic sites, particularly the ones located in coastal areas. The neolithic sites in the coastal Odisha are represented by some impressive mounds, such as at Golabai Sassan and Khameswaripalli. While those sites might have been founded before 2000 BCE, most of the substantial occupation seems to have started later. Of those, the sites of Golabai Sassan and Khameswariplalli have revealed a good number of bone tools, including the projectile and harpoon points. The presence of such weapons and the environmental contexts of those sites indicate that fishing might have played an important role in the subsistence activities. The preliminary observation of animal bones recovered from Golabai Sassan suggests the presence of cattle, sheep and goat at that site, and a preliminary observation of animal bones recovered from surface at Gopalpur indicates the presence of two domestic (cattle and buffalo) and four wild species (nilgai, *chital*, wild pig and rhinoceros) (Kar et al. 1998: 107-114). Whether the domestic animals

were present there from the beginning of Neolithic or not can only be answered after the systematic analysis of bones.

In West Bengal, information about the neolithic fauna comes from the sites of Bharatpur and Mahisadal. However, many archaeologists do not consider those sites as the pure neolithic ones, but they tend to classify those as the neolithic-chalcolithic or chalcolithic sites. Banerjee did identification of animal taxa from those sites. Accordingly, the animal remains identified from Bharatpur include the domestic animals, such as cattle, buffalo, sheep, goat and pig. In addition, people also seem to have exploited wild animals, such as nilgai, *barasingha* and barking deer, besides the possible presence of wild cattle (*Bos? nomadicus*) (Banerjee 1979-80: 162-164). The aquatic animals, such as turtles and fish were also a part of the diet of those people.

The site of Mahisadal also revealed a similar set of domestic animals as were noticed at the site of Bharatpur, except buffalo, which was absent in Mahisadal faunal assemblage. The wild animals exploited by the people at Mahisadal include spotted deer, *barasingha*, sambar, wild boar, wolf and jungle cat (Banerjee 1979-80: 163). Faunal assemblages at both those sites were dominated by cattle, suggesting the importance of bovine animals in the economic life of those people.

In the northeastern states of India, the evidence of neolithic period is mostly known from the surface collection of the ground stone axes and ceramics. David Tetso, an archaeologist from Nagaland has recently informed that the faunal remains recovered from the Mimi cave site of Nagaland have been analysed. That site represents an early neolithic culture that may be dated to *c.* 4460-4340 BCE. The site has furnished very interesting data, which makes it stand apart from other neolithic sites in the Indian subcontinent. Tetso's analysis revealed a wide spectrum of animal species at the site. The occupants of that site obtained their main food from medium-sized animals, like deer and monkeys. Bats and rodents have also appeared to contribute in a major way to the protein needs of the Mimi cave dwellers. Their food was also supplemented by fresh water fish, crabs and frogs. According to Tetso, animals not only provided meat, but their bones were also utilised for making tools. No domestic animals have been identified at Mimi cave and the major occupation of the inhabitants of the cave seems to have been hunting and fishing. The most important aspect of the faunal data from that site is the evidence related to eating of monkeys and bats. (personal communication: David Tetso) Such interesting evidence has not been reported from any other archaeological site in India. It may, however, be mentioned that this is the only work in northeastern India, where some information about the

neolithic fauna has been found. So far, no work has been done in the adjoining areas. Therefore, the picture on the role of animals in the neolithic culture in that part of the world is rather incomplete. Only systematic and intensive work-field in that region will provide adequate knowledge about the neolithic fauna in that region.

The Southern Neolithic Culture

A well-documented neolithic culture existed in south India, where a substantial number of neolithic sites have been reported from the parts of Karnataka, Andhra Pradesh and Tamil Nadu. While the neolithic research in this region goes back into the first half of CE 19th century, our knowledge and understanding has expanded greatly in the decades since India's independence. The southern Neolithic is considerably later than the Neolithic of either the Ganges or the Indus system. The dates of the southern neolithic cites mostly fall within the broad time bracket of *c.* 2900-1000 BCE. However, those dates can be further divided based on the chronology and geographical aspects. The earliest dates so far obtained from Kodekal, Utnur and Pallavoy range between 2900 and 2400 BCE. Others dates obtained from the granite hills that rise from the plateau appear to be somewhat later. Those are from *c.* 2000 onwards. The domestic equipment of the southern neolithic sites includes a wide range of heavy stone artefacts, similar to those found at neolithic settlements in north India. Copper also appears in small quantity at an early stage, but it is not clear that copper or bronze was processed from the ores or smelted in south India at that time, because no furnace has so far been discovered (Korisettar et al. 2002: 186). Throughout the neolithic period, there was a range of ceramic wares. A number of burials have also been found in the habitation areas, containing grave goods, such as chert blades, pots and something like stone axes.

Researches in the southern neolithic context are dominated by two major issues: (1) the ash mounds that are essentially accumulations of burnt cow dung, and (2) the neolithic settlements on the flat-topped hills of the region. A discussion on the ash mounds is necessary, since it is connected with the cattle pastoralism. The first reports of the ash mounds appeared between the CE 1830s and 1840s. Initially, those were described as the 'cinder mounds' or 'cinder camps', and many considered those of the volcanic or limestone origin. Some scholars thought that the mounds represented ancient burial sites, and another group of scholars believed those to be sites of ancient gold and iron workings. Gradually it was realised that the mounds were not natural geological formation, but were created by the people. Robert Bruce

Foote, based on his observations at the site of Budikanama, argued that those ash mounds were the heaps of excessively burnt cow dung that the neolithic cattle herders had made. However, only a few were convinced by his argument.

It is established by intensive research that the ash mounds were made out of the burnt cow dung. It also clear that the accumulated cattle dung was burnt, not once, but many times. That repeated burning seemed to have been a deliberate activity. According to Allchin (1963: 164), the ash mounds were, in fact, the pens in which the neolithic cattle were herded. Burning of large quantities of cow dung over a long period represented annual seasonal rites, perhaps, of purification. On the other hand, Paddayya (1991-92: 576-626) sees burning of cow dung as a simple way of disposing of unnecessary material. Korisettar et al. (2002: 215) suggest that burning may have served several multiple purposes. A more problematic issue is the nature of association of human habitation with the ash mounds. Allchin (1963: 160-165) suggested that there were two types of ash mounds: (1) those in or near permanent settlements, such as Kupgal and Gadiganur and (2) those not associated with any settlements, such as Kudatini and Utnur. However, Paddayya (1991-92: 594) thought that the ash mound and the habitation were not two separate sites, but those were related to each other. While the evidence from Budihal indicated complementary relationship the between ash mounds and habitation sites, it is yet to be seen whether a similar situation prevailed in other places or not. Another important thing to note is the location of ash mounds. Those do not occur in all the southern neolithic sites. For example, there are neolithic sites in Cuddaph district of Andhra Pradesh, but with no ash mound. Likewise, ash mounds are absent in the upper Tungabhadra Valley and southern Karnataka. Venkatasubbaiah in his Ph. D. dissertation explained the absence of ash mound sites because of different subsistence systems: the mixed farming and pastoralism. Within that system, he suggested, cow dung was used as manure. Consequently, it was not used for ceremonial and other purposes. However, an alternative explanation could have been the use of cow dung for plastering houses, for the intensity of cultivation and nature of the crops were such that it did not require the use of cow dung as manure (Korisettar et al. 2002: 214). Even so, the presence or absence of ash mounds cannot be attributed to those reasons alone and that probably had more to do with the differences in cultural traditions.

Although the nature of ash mounds is not clear, despite a wealth of researches, all researches emphasised the importance of pastoralism in the economy of neolithic sites in south India. The significant role of

ash mound sites in pastoralism is clear from the evidence of penning, accumulation of dung and predominance of cattle bones. It is clear that the southern neolithic groups opted for and specialised in cattle herding and, to some extent, sheep/goat pastoralism. Paddayya says, 'Ashmounds are an eloquent testimony to the overwhelmingly pastoral orientation of the neolithic culture of southern Deccan' (Paddayya 2000-2001: 217). Allchin suggests the penning of a large number of cattle in those pens based on the sizes of the ash mounds. Allchin observes:

> Our estimation for Utnur varied from 540 to 650 beasts when the pen was at its smallest, to 800 when the pen was its greatest. Applying the same modules to the area of some of the other mounds we find that Gaudur pen could have accommodated from 1300 to 1600 beasts; the Wandalli pen from 1000 to 1200; and the Talmari pen a similar number. We consider that these figures are more likely to err on the side of conservation than excess, as the action of weather and of local agriculturalists has steadily reduced the areas of the mound; but nevertheless the figures are quite convincing, as indications of the size of a good medium herd and of the larger herds of Neolithic cattle.
>
> *Allchin 1963: 163-164.*

Let us turn our attention to the faunal remains of the southern neolithic sites. The analysis of animal bones from southern neolithic sites revealed the presence of a range of species that include both domestic and wild animals. However, it has been noted that one species held prominent status in the southern neolithic society—the humped cattle (*Bos indicus*). That can be recognised from several lines of evidence. First, the bones of cattle outnumber those of other species in almost every southern neolithic site. The fact that those animals were humped is ascertained from the presence of neural spine of the thoracic vertebrae in the faunal assemblages. Secondly, the presence of humped cattle may be noted from the rock paintings that are concentrated at and around the southern neolithic sites. Bulls, in particular, are recurrently depicted, and their humps and horns are usually stressed. Thirdly, cattle statuettes dominated the assemblages of the terracotta figurines recovered from the southern neolithic sites. Here also, the emphasis is on the accentuated hump and horns. Fourthly, there is an evidence of the hoof impressions of cattle, which were exposed from the floor of a cattle pen at the site of Utnur. However, the most crucial evidence of the importance of cattle in the southern neolithic society came from the accumulated dung attested to in the ash mounds. All those evidence indicate that cattle occupied a very important position in the life of southern neolithic people.

The marks indicating cutting, splitting and chopping, and the evidence of charring of cattle bones show that beef was the most commonly consumed food item. However, Boivin et al. posit that cattle were probably not kept to support everyday consumption. That requirement was primarily met from the sheep/goats and crops. On the other hand, cattle were likely to be a symbolic resource, and their consumption might have taken place only during the larger ritual gatherings on some of the bigger ash mounds, as is indicated from their studies at the site of Sanganakallu-Kupgal in the Bellary district of Karnataka. While this may be the case, it requires further systematic research to be confirmed (Boivin et al. 2005: 63-89). Cattle were certainly the prized animals, and their economic and social value extended well beyond their nutrient value. They could not only have been the source of fuel and fertiliser, but also of power. **(Fig. 5.7)** The evidence of anchylosis (a condition in which two bones process of ossification) of the hook joint identified at the sites of Hallur and Utnur indicate that the cattle were used for heavy draft work. Other cattle products, such as milk, might also have been a regular item of diet of the neolithic people, and those might well have been traded between the neolithic groups(Alur 1990: 136-137, 156).

Fig. 5.7 Use of cow dung as a fuel

Based on the morphology of horn core and the relative sizes of specimens recovered from a number of south Indian neolithic sites, two different breeds of cattle are suggested in the southern neolithic sites: one is the long horned, slender bodied and humped, and the other is a massively built type. However, it is very difficult to distinguish breeds in any faunal assemblage in the absence of any statistical data based on measurements.

Sheep and goats have also been frequently reported from the southern neolithic sites, though in the much smaller quantities in comparison to the cattle. Their role of in the southern neolithic economy had been very important, but that has not been understood properly. The

dominance of cattle bones in southern neolithic sites has created a bias towards cattle pastoralism to the exclusion of other possible components of the neolithic economy, like sheep and goat herding (Korisettar et al. 2002: 192193). Other domestic animals included buffalo, pig, horse, donkey, dog and domestic fowl. The water buffalo and domestic pig have been reported occasionally and in very small quantity. The pig bones recovered from a number of southern neolithic sites were clearly of the larger and wild type, and those may represent wild game. The presence of domestic water buffalo has been testified in the faunal assemblage from Banahalli, and the presence of horse has been reported from Hallur during the late neolithic phase. That phase probably belonged to the second half of second millennium BCE. Therefore, its presence may not be surprising on the chronological grounds. It is also important to note that the later megalithic culture in south India is generally seen as having evolved out of the southern neolithic culture and the symbolic importance of horse in those Iron Age burials is abundantly clear. The presence of the donkey has been attested at the sites of Kodekal and Brahmagiri, and it is highly probable that it was used as a beast of burden.

The wild animals identified at those sites included gaur, sambar, spotted deer, *barasingha*, nilgai, blackbuck, gazelle, four-horned antelope, jungle cat, hare, squirrel, porcupine, monitor lizard and tortoise. A solitary bone fragment represents the elephant from the upper neolithic phase at Piklihal. A man driving an elephant is represented on the cylinder-seal recovered from the site of Maski, which may indicate that the elephants were tamed during the neolithic times (Chattopadhyaya 2002: 390). The rhinoceros has also been reported from the site of Palavoy. In addition, the common house rat, fish and invertebrates, like freshwater mussel and banded pond-snail, also made their presence felt in the faunal assemblages. According to Chattopadhyaya, the *barasingha* described in reports as *Cervus duvauceli* should be more appropriately identified as *Cervus duvauceli branderi*, a race of central and peninsular India (Chattopadhyaya 2002: 390).

Although, the bones of peacocks and snakes have not been identified at any of the southern neolithic sites, pictorial evidence suggests that those animals were known to the neolithic people. The bones of wild animals have been reported in very small numbers in comparison to those of the domestic ones. However, it is again important to note that the discussions on faunal economies only highlight pastoralist way of life. That may create a bias against other taxa, mainly due to the general practice of hand collection of animal bones from the sites. Further systematic wet sieving and the small bone fraction recovered

in flotation need to be investigated for additional information on the use of smaller taxa, like fish, in the neolithic times. Research on the occasionally occupied neolithic (and perhaps earlier) cave sites in the Kurnool district has revealed an assemblage heavily dominated by the wild taxa (Roberts et al. 2014: 5848-5853). While it may be safe to say that the southern neolithic economy was dominated by cattle, a more comprehensive picture can be developed by further research. The Kurnool cave sites and other neolithic sites in the region can be compared to see the extent of wild versus domesticated species that were kept and consumed.

A look into the botanical remains from the southern neolithic sites reveals that crop husbandry was based on four staple plants: brown-top millet, bristly foxtail millet-grass, horse gram and mung bean. All of those might have been domesticated from the local wild ancestors, found in the deciduous forested ecozone between the Western Ghats and the semi-arid maiden scrubland of Karnataka. In due course, the southern neolithic people also seem to have adopted wheat, barley and winter pulses (Fuller 2007: 393-443). Those inferences indicate that the crops, along with the cattle pastoralism, also played a role in the food economy of the southern neolithic people. The earlier suggestion that the southern neolithic culture was wholly pastoral must be disregarded. The final picture of the southern Deccan neolithic setting would be a series of smaller and localised settlement systems, each showing a good degree of integration of agricultural, pastoral and other activities that could provide enough scope for the exchange of items, including food products. One or a few large sites in each system might have served as the periodic congregation points (Paddayya 20002001: 219). Therefore, what is more interesting is to reconstruct the social and ecological conditions of the southern neolithic society. However, only more systematic evidence to straighten out the use of both animal and plant species can achieve that.

The southern neolithic sites have also revealed the presence of bone tools. The major types reported from those sites include arrowheads, scrapers, awls, needles, points, harpoons and chisels. Cattle bones and antlers seem to have been the most preferred raw material for a number of those tools. However, those bone artefacts have yet to receive detailed treatment.

THE CHALCOLITHIC TRADITIONS

As compared to the neolithic sites, the chalcolithic cultures have a much wider distribution, being found in the entire Ganga Valley, eastern Rajasthan, western Madhya Pradesh, Gujarat, western Maharashtra and the northern Vindhyas. Those chalcolithic cultures traditionally include non-urban, non-Indus cultures, characterised by the use of copper and stone tools, such as axes, adzes, wedges and chisels. While the architectural features in the neolithic sites were simple, the architecture in some of the chalcolithic cultures show incipient settlement planning, impressive multi-roomed houses and even defensive structures, like ramparts and moats. All those chalcolithic cultures have regional character and a gradual development is visible in respective regions.

The Ahar Culture

The Ahar culture flourished in southeastern Rajasthan, which has been one of the most fertile regions of India. In some literature, that culture is also known as the Ahar-Banas cultural complex, because most of the sites have been discovered on the banks of Ahar and Banas rivers. It was well defined by the excavations at Ahar, a type-site. There are approximately one hundred Ahar culture settlements known today. Those settlements are located in the valleys of Banas, Berach, Gambhiri, Kothari and Khari rivers and their tributaries. Out of southern Rajasthan, Ahar pottery also extends to the east into Madhya Pradesh. The most distinguishing feature of those sites, and in many cases, the defining feature of the Ahar culture is the characteristic black-and-red pottery, decorated with the white paintings. The chronological range of the Ahar culture sites is 3200 to 1400 BCE, although dates at Balathal begin at *c.* 3700 BCE or earlier (Misra 2005: 54-60). The development of that culture is thought to be gradual, as seen in the material culture, particularly in structures and pottery. That gradual cultural process culminated into the formation of a flourishing and developed phase around the middle of third millennium BCE (Shinde 2010: 5-10). One of the important factors for the development of Ahar culture sites was trade contacts with the Indus people around 2500 BCE, resulting in reciprocal cultural impact and exchange.

Some of the important sites of Ahar culture, where faunal analysis has been conducted, are Ahar, Ojiyana, Purani Marmi, Tarawat, Balathal and Gilund. A brief discussion on the results obtained from those

analyses is given hereunder.

Ahar, the type-site of Ahar culture, was excavated by Deccan College (Pune), University of Melbourne (Australia) and the Rajasthan Department of Archaeology. The excavations at the site brought to light two periods: (1) 'Period I' (Chalcolithic) and, (2) 'Period II' (Iron Age). 'Period I' was further subdivided into sub-phases 'Ia', 'Ib' and 'Ic'. Shah analysed the faunal material recovered from Ahar and revealed the presence of eight domestic animals like cattle, buffalo, sheep, goats, pig, ass, dog and chicken, in addition to five wild species (Shah 1969: 237-245). The domestic ass was probably utilised for transporting heavy loads. The domestic fowl was found only in the later Ahar occupation, indicating some sort of poultry practice during the later phase of the chalcolithic culture. Tetso, for his Ph. D. dissertation, worked out NISP for the domestic species from the data that Shah published. His analysis revealed that the domestic species dominated the faunal assemblage in all the three chalcolithic phases at Ahar. The percent frequencies of domestic animals accounted for 98.54 percent, 94.94 percent and 93.77 percent for period 'Ia', 'Ib' and 'Ic', respectively. Cattle dominated the assemblage and those were the chief source of food throughout the subsistence economy at Ahar.

Another chalcolithic site showing affinity with Ahar is Ojiyana, where excavations were carried out by the Jaipur Circle of the Archaeological Survey of India (ASI). The excavations brought to light a 7.5 m single cultural deposit belonging to the Ahar culture, which was divided into three cultural phases, based on ceramic and structural activities. Joglekar and Tetso did the faunal examination of that site and identified 17 species of animals that comprised four domestic mammals (cattle, buffalo, goat and pig), 11 wild mammals and two non-mammal species (Joglekar et al. 2009: 83-87). Although, domestic animals dominated the assemblage in all the three phases at Ojiyana, yet the representation of wild animal increases gradually from 'Phase I' to 'Phase III', indicating the importance of wild animals towards the end of the chalcolithic period. Another ancient site of Purani Marmi, on the right bank of River Banas in the Rasin *tehsil*, Chitaurgarh district revealed the evidence of Ahar culture. An analysis of the faunal remains recovered from that site revealed the presence of four species of domestic mammals (cattle, buffalo, sheep and goat), two wild mammals (blackbuck and spotted deer), domestic fowl and two freshwater molluscan species. As seen in the other Ahar culture sites, the assemblage at that site was also dominated by cattle. Similar evidence from the recently excavated site of Gilund indicates a preference for domestic animals over their wild counterparts, with large stock (cattle/buffalo) clearly dominating the economy. The other

animals identified at Gilund include sheep/goat, blackbuck, deer, rabbits, rodents, snakes, birds, fishes, bivalves and snakes (Landt 2010: 22).

Balathal, a unique site with a massive fortified enclosure, was horizontally excavated by the Deccan College, Pune and the Institute of Rajasthan Studies, Udaipur. The excavations at that site revealed two cultural periods: the chalcolithic, similar to that noted at Ahar and the Maurya-Kushan. A large number of animal skeletal elements were collected from the site during the course of excavations. Thomas and Joglekar studied a part of those faunal remains (Thomas and Joglekar 1996: 91-97). Recently, David Tetso studied a large amount of faunal data from that site for his doctoral dissertation. His efforts revealed a large number of animal species that included domestic and wild animals. Among the domestic animals were cattle, buffalo, goat, sheep, dog, cat, pig, and wild animals that included wild buffalo, wild pig, wolf, jackal, fox, hyaena, wild cat, leopard, nilgai, four horned antelope, *chinkara*, blackbuck, sambar, barking deer, *chital*, mongoose, hare, porcupine, rodent, chicken, peacock, few reptiles and a small quantity of molluscs.

As is generally the case with other Ahar culture sites, the faunal assemblage at Balathal was dominated by cattle. In general, the inhabitants at the site practiced a mixed economy of raising stock, farming and hunting. Though wild life was plentiful during the chalcolithic period at Balathal, their contribution to the subsistence system there was not great, as the number of such bones gradually decrease in the upper levels. An important feature of that site was the intentional burial of cattle skulls, lower jaws and occasionally, complete limbs in the settlement area (Thomas and Joglekar 1996: 91-97).

As noticed above, the general pattern of animal use at the Ahar culture sites shows the predominant position of cattle among all the domestic animals, followed by the sheep and goats. Cattle not only were used as a chief source of meat in the food economy, but also were probably used for transportation, traction and other agricultural work. Goats and pigs were also kept and slaughtered. Probably, the dog had a close symbiotic tie with humans. Besides domestic animals, the chalcolithic people hunted wild animals, but their contribution to the food economy as a whole was marginal. The Ahar people were also agriculturalists, who grew wheat, barley, pulses, pearl millet, and finger millet. What appears to be the economic process of pastoralism in the Banas River basin was the utilisation of cultural and ecological framework to develop an agro-pastoral community and way of life. Excavations at Ahar sites have also yielded a number of bone and shell artefacts. A

number of terracotta bull figurines have also been recovered from Ahar sites. In fact, the site of Purani Marmi appears to be the production centre of such figurines. One can still pick up a number of such figurines right from the surface at Purani Marmi. **(Fig. 5.8)**

Fig. 5.8 Bull figurines from Purani Marmi, Rajasthan

The Kayatha and Malwa Culture

The Kayatha culture is named after the site where late Wakankar first discovered it and also excavated the site in 1965 and 1966. Later on, Deccan College, Pune in collaboration with Vikram Univeristy, Ujjain re-excavated that site. The site of Kayatha, district Ujjain, Madhya Pradesh, is located on the right bank of Choti Kali Sindh, a tributary of the Kali Sindh, which joins the Chambal River. The excavations at the site revealed a five-fold cultural sequence, of which the first has been labelled as the Kayatha culture. The culture is characterised by three distinct ceramic industries, which have no parallels in the country. It has been radiocarbon dated to 2000-1800 BCE (Dhavalikar 1994: 159-168). Those dates are calibrated to *c.* 2300-2000 BCE (Possehl and Rissman 1992: 465-490). The Kayatha culture at the site was followed by the Ahar culture and the Malwa culture. The Malwa culture (*c.* 1800-1200 BCE) was another distinctive chalcolithic tradition, which was first discovered at the sites of Maheshwar and Navdatoli. The Malwa culture seems to represent the pioneer colonisers of that region over a major part of Madhya Pradesh. The excavations at Navdatoli

have shed considerable light on the material inventory of the Malwa culture. The Malwa culture is characterised by a distinctive painted black-on-red ceramic.

Alur and then Clason studied the animal bones at the site of Kayatha collected from the first three periods (the Kayatha, the Ahar and the Malwa) (Alur 1975: 157-163; Clason 1974: 78-89). The analysis showed the presence of cattle, sheep, goats, and pigs at the site. In addition, wild animals, like elephant and blackbuck have also been identified. Furthermore, Alur identified the remains of horse in all three periods. Tortoise remains have also been recovered from the site. The skeletal remains of cattle were found to be the most abundant in the faunal assemblage. A large number of terracotta animal figurines were found from the levels ascribed to the Ahar and the Malwa cultures. Those include several varieties of bull figurines that can be divided into two major types: (1) naturalistic and, (2) stylised. While such specimens were recovered from the Ahar culture sites in Rajasthan, their quantity at Kayatha is indeed significant. According to Dhavalikar, 'Numerous terracotta bull figurines particularly the stylised one from the Ahar and Malwa levels at Kayatha clearly indicate the existence of a sort of bull cult' (Dhavalikar 1994: 166). Misra et al. think that the bull figurines recovered from the Ahar culture sites were probably votive offerings, as that practice is very common among native societies all over the country and particularly in middle India from Gujarat to Odisha (Misra et al. 1993: 152).

George and then Clason analysed the animal skeletal remains recovered from Navdatoli (Malwa tradition), situated at the left bank of River Narmada (George 1958: 256-257; Clason 1974: 78-89). Those analyses revealed the same spectrum of domestic animals that include cattle, buffalo, sheep, goat and pig. Horse and donkey also made their presence felt in the faunal assemblage. The wild mammals identified from that site include nilgai, blackbuck, gazelle, and probably some deer, like sambar, *barasingha*, spotted deer and hog deer (George 1958, Clason 1974: 78-89). One fish bone and remains of tortoise have also been recovered. The dependence on domestic animals is same as seen in the Ahar culture sites. Bones of the humped cattle were the most numerous. However, pork also seems to have been quite popular at Navdatoli. The study of pig bones revealed that most of the pigs were about half a year old or more. Classon thinks that the killing of half-year-old pigs might have synchronised with the birth of new litters just before and after the rains (Classon 1974: 78-89). Presence of copper fishhooks at the site showed that fishing might also have played an important role in the subsistence activity of the people. A few tools made on animal bones, and ornaments, such as

rings and bangles of shell, have been collected from the site.

In addition to the animal remains recovered from the site of Navdatoli, the information about animals also comes from the rich paintings depicted on pottery. The most frequently depicted animals are the blackbuck and the peacock. The ox and dog also have been depicted. Other animals depicted include cats (tiger, panther and probably, fox), birds (fowl, pigeon, a row of flamingos, and a bird of prey), rodents, crocodiles, tortoise and butterflies (Classon 1974: 78-89). The depiction of so many animals on pottery clearly shows that those people had a keen interest in the animals that surrounded them. The initial occupation at Navadatoli, according to calibrated radiocarbon dates, began in first quarter of the second millennium BCE and continued up to 1300 BCE.

The sites of the Kayatha and Malwa cultures have also revealed a good amount of plant remains. That indicates the presence of a stable economy at those sites, dependent upon agriculture, raising stock, hunting and fishing. However, hunting does not appear to have played a very significant role in the subsistence economy of those people.

The Deccan Chalcolithic

The Deccan Chalcolithic is the best-studied culture of its kind in India. The Deccan, comprising the plateau region of south India between the Narbada and Krishna rivers, roughly extends over the entire state of Maharashtra and parts of Karnataka and Andhra Pradesh. The Savalda (*c.* 2200-2000 BCE) and the Narmada (*c.* 1400-700 BCE), known after the type sites, are the important chalcolithic traditions in this region. The Jorwe culture has been further sub-divided into the earlyJorwe (*c.* 1400-1000 BCE) and the late Jorwe (*c.* 1000-700 BCE). It appears from the available evidence that the late Jorwe culture was confined to the Bhima Valley, and it represents the end phase of the Chalcolithic of the northern Deccan (Dhavalikar 1989: 158). The Jorwe culture was preceded by the Malwa culture at a number of sites in northern Deccan.

The Savalda culture is characterised by a distinct ceramic tradition, which is coarse in fabric and often with a gritty core. That Savalda ware is unique in the entire ceramic range of the Deccan Chalcolithic, because of the variety of delicately painted motifs. Those include, besides linear and geometric pattern, figures of wild animals and birds, such as elephant, wild boar, peacocks, cocks, snakes and aquatic animals, like fish and frog (Shinde 1994: 172-173). Sometimes, hunting objects like harpoons, bows, arrows and swords have also

been depicted in the black pigment on the pottery (Shinde 1994: 173). A large number of sites have been discovered in the Tapi Basin, of which Savalda, Daimabad and Kaothe have unfolded various facets of that culture. The Jorwe culture was also characterised by a distinct ceramic with painted motifs decorated with black pigment. However, unlike the Savalda ware, the animal motifs are quite rare. The common animal motifs are the stylised deer, fish-scale patterns and cranes. To date, more than eighty sites of that culture have been discovered. Of those, excavations have been conducted at the sites of Inamgaon, Daimabad, Chandoli, Nevasa, Jorwe, Nasik, Prakashe, Bahal, Tekwada and Walki. The horizontal excavations at Inamgaon and Daimabad have contributed largely to understanding the lifestyle and socio-political organisation of those chalcolithic people.

While a large number of Deccan chalcolithic sites have also been excavated, revealing large amounts of faunal data, our knowledge of the animals associated with those sites is fragmentary and limited to only a few sites. Faunal reports from sites like Apegaon, Nevasa, Daimabad and Nasik, among others, are merely brief taxonomic descriptions of species. From other sites, the excavation reports mention nothing about the faunal remains, except for stray references to animal motifs on terracotta wares, which are of little help for finer archaeozoological interpretations. Detailed faunal reports are available only for four sites: Tuljapur Garhi, Inamgaon, Walki and Kaothe. Of those, the site of Inamgaon is a very important site. The site was systematically excavated for 13 seasons, and thus we now have a good idea of the life of those chalcolithic people. In addition, the faunal remains of that site have also been extensively studied. Therefore, the site of Inamgaon will be discussed here in detail.

Inamgaon, a village in Sirur taluka of Pune district, is located 89 km east of the Pune city. The ancient site, three km away from the modern village, is situated on the right bank of River Ghod. The excavations at the site revealed three phases: (1) the Malwa, (2) the early Jorwe and (3) the late Jorwe. Multidisciplinary work was carried out at the site to throw light on the subsistence and habitation patterns, as well as on the diet and diseases of the earlier inhabitants. About 266 burials, some symbolic, have also been unearthed from the site. The faunal remains recovered from the site were analysed by the four different scholars: Badam, Classon, Thomas and Pawankar. However, it is Pawankar, who analysed a large amount of bone fragments (n=66,847) from the site during her doctoral research. Her study revealed more than 50 species of animals, consisting of both domestic and wild mammals, birds, reptiles, fish, molluscs and crustaceans. The domestic animals identified included cattle, buffalo, sheep, goat, pig,

horse, ass and dog. The most commonly represented wild animals were sambar, spotted deer, blackbuck, gazelle, four-horned antelope, hare and mongoose, and so on. Most of those animals were part of the diet of the people. The cut marks on the skull of blackbuck suggests that the brain was removed for consumption.

Animal bones have also been identified from human burials. Thomas has provided a detailed information of the same (Thomas 1988: 822-961). It must have been a custom to offer food to the dead. However, it appears that there was no particular selection of animal for offering. The animals offered in the burials included cattle, sheep/goat, pig, blackbuck, sambar and turtle (Thomas 1988: 960). Even fish appears to have been offered, as their bones have been recovered from some of the human burials. The site also revealed a number of bone tools such as points, scrapers, awls, antler picks, denticulate, notches and arrowheads. Bone tools are also associated with the human burials. Some of the first phalanges of cattle from Inamgaon revealed perforations on the dorsal side, which Thomas believes may have been used as hunting whistles.

A look into the changes in the animal-based subsistence economy in different cultural periods at Inamgaon reveals interesting data. The faunal assemblage from the first two periods at Inamgaon (the Malwa and the early Jorwe) revealed the dominance of cattle remains. Those periods also revealed a predominance of grains at the site. The irrigation canal, assigned to the early Jorwe, probably supported the agriculture and cultivation of wheat, barley and so on in those periods. Even in the early levels of the late Jorwe, the percentage of bones of cattle was much more than that of the other animals. However, the middle levels of the late Jorwe period at Inamgaon marked a noteworthy change. A considerable increase in the yield of animal bones has been noticed from there onwards. If one examines the number of animals represented in different layers, it appears that there was almost a four-fold increase in the animals killed or butchered in the deposit of the late Jorwe. That is accompanied by a decrease in the percentage of cattle and an increase in the remains of antelopes and other small ruminants, including sheep/goat. The people also seem to have exploited more avian and aquatic fauna during that period. In addition, the dog bones from the late Jorwe phase depict human activities that suggest the consumption of dog meat, which is unparalleled in any other archaeological site in India. In parts of Maharashtra, dogs are still eaten by some of the aborigines in times of severe famines and scarcity (Thomas 1988: 368). However, it seems that the people were practicing agriculture and cultivating barley as the principle cereal crop. In the initial stages of the late Jorwe period,

wheat was also grown, as was the case in the earlier periods. However, soon a decrease in the production of wheat was noticed, which completely stopped by 900 BCE (Dhavalikar 1989: 163). After that, the people appear to have subsisted more on barley, and perhaps even more on animal foods, as is suggested by the increased quantity of bones (Dhavalikar 1989: 163). The comparative analysis of tooth size and dental indices of the Inamgaon human skeletal remains also revealed a greater dependence on the animal food during the late Jorwe. The house types also marked a noteworthy change from the early Jorwe to the late Jorwe, namely, from rectangular to the circular structures.

That evidence suggested that the subsistence base of the chalcolithic people was subsistence agriculture, stock-rearing and hunting-fishing until about the close of second millennium BCE (the late Jorwe period), when due to increased aridity, the people changed to hunting and semi-nomadic pastoralism. While Panja has contended the evidence relating to the change from sedentary farming to semi-nomadic pastoralism (Panja 2003: 105-125), the site of Inamgaon provides valuable faunal evidence to understand the change in the animal-based subsistence pattern in the chalcolithic tradition of the Deccan region.

There are also extensive faunal studies carried out on the data collected from Walki and Kaothe. Those sites also showed the presence of most of the known domestic animals (cattle, buffalo, sheep, goat and pig) and a large number of wild animals, as was the case at the site of Inamgaon. At Walki, common pets, like dog, cat, horse and donkey have been identified. The wild animals reported from that site include wild buffalo, gaur, antelopes, deer, wild boar, hare, leopard, tiger, wolf and jackal. At Kaothe, sloth bear, the small Indian civet, langur, porcupine and common house rat have also been identified (Thomas and Joglekar 1990: 233-264). In addition to those domestic and wild mammals, people at those sites also made use of the other natural resources, such as birds, reptiles, fishes, crabs and molluscs. As with other chalcolithic sites, cattle played the largest role in the food economy, followed by sheep and goats. The buffalo population at Kaothe seems to be somewhat large, indicating the probability of a band of people having permanent settlements at that site. The bones of domestic pigs are very few. The Deccan chalcolithic people probably did not maintain stocks of pigs, unlike those of cattle, buffalo, sheep and goat. Those sites also revealed the evidence of both tools and ornaments made of the animal bones.

Chalcolithic Cultures of Gujarat

Chalcolithic cultures also flourished in different parts of Gujarat, and from the available data, it is evident that there was considerable cultural diversity. Apart from the ceramic evidence and few other materials, very little is known about the origin and development of those early farming communities. However, it has been recognised that those communities played a vital role in the regional manifestation of the Indus culture in Gujarat. It is also becoming clear that those communities maintained interaction within and with the societies in the core areas of Indus culture, though the nature of that interaction is not known.

One of the most important chalcolithic traditions in Gujarat is the Anarta chalcolithic one, largely confined to the north Gujarat. It has been named after the traditional name of north Gujarat. That chalcolithic tradition is one of the better-researched pre or non-Indus assemblages in Gujarat. The pottery was first recognised in the excavation at Nagwada in Surendranagar district where it was found in association with the 'mature-Indus' elements. However, its personality as an independent ceramic tradition was established after the excavation at Loteswar in Mahesana district (Ajithprasad 2002: 139). That tradition has a wide distribution, encompassing the entire north Gujarat and extending to the adjoining parts of Kachchh. The sites belonging to that culture are generally small, measuring less than three hectares. The structural remains are in the form of a few clay plasters with the reed impressions. Kukrana, Mujpur, Santhali and Nayeka are other important sites of that culture, where those are found more or less independently. The origin of that tradition has been dated at 3500 to 3000 BCE by radiocarbon determinations at Loteswar (Ajithprasad 2004: 123).

Among the Anarta sites, Loteswar has revealed some interesting faunal evidence. As mentioned in Chapter 4, Loteswar has both mesolithic and the chalcolithic deposits. The faunal remains from both of those phases have been subjected to analysis (Patel 2009:173-188). The analysis of faunal remains from the microlithic layers (between the late-eighth and mid-sixth millennium cal. BCE) revealed the remains of wild animals only, dominated by blackbucks (see Chapter 4). The blackbucks dominated the chalcolithic fauna, but with the significant addition of the bones of domestic cattle. The chalcolithic material from Loteswar comes mostly from pits dug into and through the microlithic deposits. Because of the possibility of pit deposits mixed with the earlier period, a programme of direct AMS dating of animal bones was developed at the site (Patel 2008:

123-134). Three charred bones of cattle from that phase have been dated using the AMS technique. Those dates suggest a range for the chalcolithic occupation of 1300-1500 years in the third and fourth millennium BCE (Patel 2008: 129). Those radiocarbon dates from Loteswar suggest that microlithic populations lived and hunted there during the first half of Holocene. Then after a break of one millennium or more, the site was re-occupied by the chalcolithic populations. The occurrence of the large wild cattle at the microlithic phase and the presence of morphometrically small-sized domestic cattle during the chalcolithic phase at Loteshwar raise an important issue of local domestication of cattle in north Gujarat. Patel says,

> …the broad distribution of wild cattle through much of the northwestern South Asia leaves open the possibility that there may have been multiple local centres of domestication of these animals. As noted, there are remains of large wild cattle in the Aceramic Microlithic deposits at Loteswar, indicating that such animals were available locally. This, together with the presence of morphometrically small-sized cattle at Loteswar by the first half of the fourth millennium cal. BC, suggest that North Gujarat is an important area to investigate for the possibility of local domestication.
>
> *Patel 2009: 181.*

It is important to note that north Gujarat is dotted with the mesolithic and non-Indus sites or with the sites where the chalcolithic deposits are right over the mesolithic deposits, such as at Datrana, Moti Pipli, Santhali and other sites.

Saurashtra (southwestern part of Gujarat) was also the home for a few early chalcolithic communities, spread into different pockets of this region. The pre-Prabhas culture, unearthed at the Prabhas Patan site in the southwestern coastal area of Saurashtra in Junagadh district brought to light one such community. The incised red ware, red ware, black-and-red ware and grey ware characterised that culture (Dhavalikar and Possehl 1992: 72-73). That phase was dated by radiocarbon to *c*. 3000 BCE (Possehl 1992: 145). This early date from the pre-Prabhas level became a source of debate and discussion, as the possibility of existence of a regional chalcolithic culture was not appreciated at that time. However, the evidence for a settled life from different regions of Gujarat contemporary with the chronology of the pre-Prabhas culture indicated that it was one of the earliest agricultural settlements in Gujarat, with a distinct ceramic tradition. The animal remains recovered from the pre-Prabhas were analysed by Thomas, which revealed that people were practising a combination of hunting

and raising stock during that phase. The animals identified from that site included domestic mammals, such as cattle, buffalo, sheep, goat, and pig, and the wild mammals, such as gazelle, *barasingha*, spotted deer and porcupine. The aquatic food resources were fish, tortoise and molluscs. In addition, two species of crabs, the *Portunus sanquinolentus* and Ozius *tuberculatus* were identified (Thomas 1979: 176-186).

Another chalcolithic assemblage from the region of Saurashtra has been brought to light at Padri, located in the coastal region of Bhavnagar district. The lowest level there revealed a non-Indus ceramic tradition, which was christened as 'Padri Ware' after the name of site. The lowest level of Padri is dated between c. 3600 and 2900 BC. The domestic animals identified from that phase include cattle, sheep/goat, and buffalo. In addition, there are four wild mammalian species (blackbuck, gazelle, four-horned antelope and spotted deer) two rodent species and one reptilian species.

Ochre Coloured Pottery Culture

The OCP forms the earliest post-Indus chalcolithic tradition. That tradition covers a wide area that ranges from the Ganga-Yamuna *doab* in the east to Rajasthan in the west. Maximum concentration of the sites has been recorded in the *doab* region. That chalcolithic tradition flourished between the early and mid-second millennium BCE. However, thermoluminescence dates from several sites indicate a time bracket from 2650 to 1180 BCE. There is a strong correlation between the OCP and the enigmatic copper hoard implements that included celts, hatchets, harpoons, spearhead, antennae sword, rings and anthropomorphic figures, among others. Of those, the so-called 'anthropomorphic' figures are more distinctive and significant.

Atranjikkera and Lal Qila are the only two OCP sites, from where Shah analysed the faunal material. The OCP period at the site of Atranjikhera revealed a very small number of faunal material of which only two species have been identified in the form of domestic cattle and tiger (Shah 1983: 469). However, a study conducted on the faunal remains recovered from Lal Qila brought to light nine species that included seven domestic species (cattle, buffalo, sheep, goat, pig, dog and horse), one wild species (nilgai) and an avian (*Gallus* sp.). The cattle (74.2 percent) dominated the assemblage. 'As no taphonomic analyses have been carried out, one is not sure about the representativeness of the faunal data. The sample recovered in fact shows a bias towards large bones and it is not safe to draw any serious conclusion about relative taxonomic abundance. The only

conclusion that can be drawn from this analysis is the fact that the OCP people practised animal husbandry involving a number of domesticates, and that they were familiar with horse' (Chattopadhyaya 2002: 404). A number of tools made of bones, such as arrowheads, points and styluses have been recovered from the OCP sites.

The Emerging Picture

The faunal evidences from different regional neolithic and chalcolithic traditions of the subcontinent are certainly useful for understanding the evolving human-animal relationship. A look into the above account mat clearly show that animal husbandry and agriculture constituted the base for those early farming communities. However, whether the animals were locally domesticated or brought as the domesticated from other places has not been adequately studied. While Mehrgarh revealed the development of agriculture and animal husbandry in Baluchistan from early seventh or late eighth millennium BCE onwards, such development in the agriculture and animal husbandry is not clear in other parts of the subcontinent.

However, Mehrgarh may not be a unique site where the beginning of barley-wheat agriculture or sheep-goat-cattle domestication is to be confined. More such comparable or later settlement sites may still be lying buried beneath the alluvial deposits. Therefore, it is very difficult to say whether Mehrgarh was an isolated community or a part of large network of farming settlements in that region. Interesting evidence comes from the two Ak-Kupraq caves in Afghanistan, which are said to contain domesticated sheep and goats in the aceramic levels. The aceramic levels in those caves could date between 8500 and 7000 BCE or even earlier, if one focuses on the tails of radiocarbon probabilities (Fuller 2006: 28). In addition, it is also not clear whether the people at Mehrgarh were directly involved in the domestication process. Chattopadhyaya says:

> What is not explicit in the archaeological evidence, and may be a fair possibility, is that the inhabitants of Mehrgarh were not necessarily involved directly in the domestication of all the three animal taxa: cattle, sheep, and goats. Rather domestication was the result of an on-going human-animal symbiotic relationship involving specialised, mobile or semi-sedentary communities (for respective species) operating in wide areas around the site.
>
> *Chattopadhyaya 2002: 407.*

From the perusal of account of faunal remains recovered from the neolithic and chalcolithic sites, it becomes clear that investigations of the early animal husbandry in India focuss only on the sites of sedentary nature from the mid or the late third millennium BCE that are archaeologically visible in most parts of India. Consequently, those

sites reveal a full complement of already domesticated livestock and crops. However, those studies indicate that the integration of animal husbandry and cultivation must have occurred earlier amongst mobile communities that were archaeologically less visible. The potential of sorting out those processes seems high in the Ganga Valley and western India, particularly in Rajasthan and Gujarat, as those are the regions where the mesolithic sites have been widely identified and in some cases have good archaeological integrity. In Gujarat and Rajasthan, the so-called neolithic tools are absent and the chalcolithic material is quite often found directly resting on the mesolithic material, as the sites belonging to Anarta culture in Gujarat indicate. The faunal studies carried out at the chalcolithic site of Loteswar and the Indus site of Dholavira (see Chapter 6) have already suggested the possibility of an indigenous domestication of both cattle and buffalo in Gujarat.

The early prehistoric paintings at Bhimbetka and other rock-shelter of central India and the eastern Vindhyas quite often depict both humpless (large cattle with long horns) and smaller humped cattle (zebu). The humpless cattle generally predate the zebu. Those paintings may be dated to a time span of early to mid-Holocene. Because of that evidence, it may be possible that central India was an independent region of close human-cattle symbiotic relationship, leading to cattle husbandry practices (Chattopadhyaya 2002: 408). Recent genetic evidence also reveals a striking pattern that indicates the induction of wild cattle into proto-domestic zebu in Ganga Valley and central India (Chen et al. 2010: 1-6). If that is the case, then the domestic cattle identified at the chalcolithic sites of Gujarat, such as Loteswar and mesolithic sites of Rajasthan, such as Bagor, may have been of the central Indian rather than of Mehrgarh origin. However, the same cannot be suggested for the sheep and goat, as those sites lie outside the range of natural habitats of the wild sheep and goat. The recent work at Lahuradeva suggests that future work in that region may elucidate both the plant and animal economies of less settled societies that passed through the transitional phases between foraging to food production.

Another possible centre of cattle domestication seems to be the southern India. Although the southern neolithic sites provide the earliest evidence for pastoralism and agriculture in the peninsular India, the origin of pastoralism deserve further investigation in this region. The notable morphological differences between the cattle depicted in the rock art of south India and iconography of the Indus civilisation have led to the suggestion that south India was an independent centre for cattle domestication. While the

archaeozoological data confirming such a scenario is still lacking in the region, there is some genetic evidence that suggests that south India may have been an independent centre of cattle domestication. Naik's comparative study of blood group factors and the haemoglobin variants among several Indian breeds of hump and humpless cattle suggests a separate ancestry. According to him, the contemporary existence of northern and southern zebu and their distinct morphological depiction from ancient times, suggest different centres of domestication in India (Naik 1978: 23-30). While the evidence for the late distribution of wild aurochs in the south India is scarce, there is a possibility that it may have existed there in certain pockets. The presence of domestic buffalo, sheep and goats in the southern neolithic sites also raises some questions, like at what stage were those species domesticated? Were they either introduced in domesticated form from the north or were they domesticated locally? It is clear that by the mid-third millennium BCE, southern neolithic sites had a mixed economy of pastoralism and crop cultivation. However, which came first (the domesticated animals or plants), and where precisely that happened, needs to be resolved through further research.

It is important to note that there is no evidence of pig domestication at Mehrgarh. However, an initial increase and subsequent rapid decrease of pig remains in successive periods at Mehrgarh raises the possibility that attempts were made to keep pigs during the late fourth millennium BCE. In fact, clear archaeological evidence suggesting indigenous domestication of pigs has not been reported anywhere at any period in South Asian sites. Pig bones form a very small component of the faunal assemblages in South Asian sites, which precludes any concentrated study focusing on the morphometric evidence for their domestication. However, recent genetic studies have suggested multiple events of indigenous domestication of pig in that area. A similar situation can be seen in the case of chicken, where there is no morphological evidence for a domestication process. Chicken bones occur in reasonably large quantities in the mesolithic Damdama (Thomas et al. 1995a: 29-36). The dating of that site and chicken bones is crucial in throwing light on such earlier evidence of keeping chickens. However, evidence from the Indus sites indicates that those birds were kept by the Indus peopel (see Chapter 6). Genetic studies, have suggested multiple origins for domestic fowls in South Asia and Southeast Asia.

The studies pertaining to the chalcolithic cultures like Ahar, Malwa and Jorwe suggests that the chiefdoms might have emerged in those cultures. The site of Balathal in Rajasthan has provided evidence of a

fortified enclosure. That kind of monumental structure could have been made only by employing organised labour. While the exact function of that fortified enclosure is unknown, that certainly indicates the existence of a chiefdom kind of social organisation. The northeastern area of Balathal enclosure has revealed the evidence of an enormous amount of dumped cow dung. It is possible that some sort of religious activity was going on in a part of that enclosure in which perhaps cow dung was also used. In the Deccan chalcolithic complex, different components of social organisation that chiefdom would involve, such as craft specialisation, public architecture and residential structures, and burials of the chiefs and others have been identified. While agriculture and cattle husbandry appear to be the chief occupation of those people, later on, metallurgy was also included. Thus, we have the remains of hunting, gathering, pastoralism, semi-sedentary and sedentary stages, followed by the large village settlements, emergence of chiefdoms and ranked societies. However, due to the lack of multidimensional studies, it is difficult to illustrate the possible exchange between different regions (western and central Indian or central Indian or Deccan), not only in various craft activates, inter-site relationships and the gradual change in lifestyle, but also in the subsistence resources, including both plants and animals.

The presence of a wide range of bone tools in both the neolithic and chalcolithic sites show that those tools were used for a wide array of tasks and on a wide range of raw material. Those could have been used to remove the bark from poles and branches; split, scrape and shape wood; for de-fleshing and scraping hides; for softening leather; for sawing hides and textiles; for scraping, burnishing and polishing pots; for basketry and weaving, and also as digging tools. However, the shape of a tool is not sufficient for assigning a specific function to it, and here, microwear analyses become a necessity. Bone tools are especially abundant in some sites as compared to others. Many bone tools are not standardised in size and form, and seem to have been roughly made. That may indicate the absence of craft specialisation in making those tools, and that the tasks for which those tools were used varied widely.

It must also be admitted that the study of a large number of sites belonging to the neolithic-chalcolithic cultures is largely confined to the typological analysis of stone tools and pottery. The reconstruction of lifestyle and subsistence pattern of those people has not been attempted seriously. Therefore, the challenge for future researchers is to document both, the faunal and floral remains in a better manner to investigate the advent of both livestock and crop cultivation.

6.

Animals in the Indus Civilisation

THE INFORMATION ABOUT THE ANIMALS DURING THE INDUS PERIOD comes from the bones recovered from various sites and the representations on seals, figurines, and other objects, which indicates that the life during the Indus period was dependent upon a diverse suite of animals. The first evidence about the role of animals in the Indus subsistence economy appeared nearly eight decades ago, when a few bones from Harappa were examined. Since then, several scholars have studied animals in the different regions of the Indus culture. The present chapter that summarises the role different animals played during the Indus civilisation, largely based on the archaeozoological data, and to a minor degree, on the iconographic evidence. It also includes a discussion on the evidence of archaeozoological data and comments on the studies focusing on animals during the period of Indus civilisation, However, the topics taken up in this chapter are not definitive or exclusive, but the ones that appear to be important ones.

The Indus Civilisation

The formal announcement of discovery of Mohenjodaro and Harappa on 20 September 1924 in the Illustrated London News by Sir John Marshall brought to light a civilisation of the Bronze Age (Marshall 1924: 528-532). The discovery of that civilisation was one of the major achievements in archaeology. That civilisation since then has been known by several names, such as the Indus Valley Tradition, the Indus Valley Civilisation, the Indus-Saraswati or Sindhu-Saraswati Civilisation and the Indus Civilisation. Those different names were the attempts not only to integrate a wider geographical area for that civilisation, than just the Indus River region, but also to accommodate the changing anthropological terminology.

For the first half century after that discovery, the Indus civilisation was virtually synonymous with Mohenjodaro and Harappa, as no other major cities were known. However, the knowledge about that civilisation has grown tremendously during the later half of 20th century. Intensive and extensive works carried out in the last several decades have brought to light a large number of sites that throw light on various aspects of that ancient civilisation. The numerous Indus settlements recognised so far include large and small villages and towns. Of those, five sites—Mohenjodaro, Harappa, Ganweriwala, Rakhigarhi and Dholavira—are the major urban centres. The distribution of Indus settlements runs broadly from Sutkagendor in Makran (Pakistan) in the west, to Hulas in district Saharanpur in Uttar Pradesh (India) in the east, Manda in southern Jammu, Jammu & Kashmir (India), Rehman Dheri (north Pakistan) in the north, Daimabad in Maharashtra (India) in the south. Estimates about the extent of its area vary from scholar to scholar and depend upon one's definition of the 'Indus', or for that matter, whether one can include the whole of Baluchistan and Afghanistan despite the fact that the number of sites in those regions is small. However, geographically it is the largest of the early civilisations. (**Fig. 6.1**)

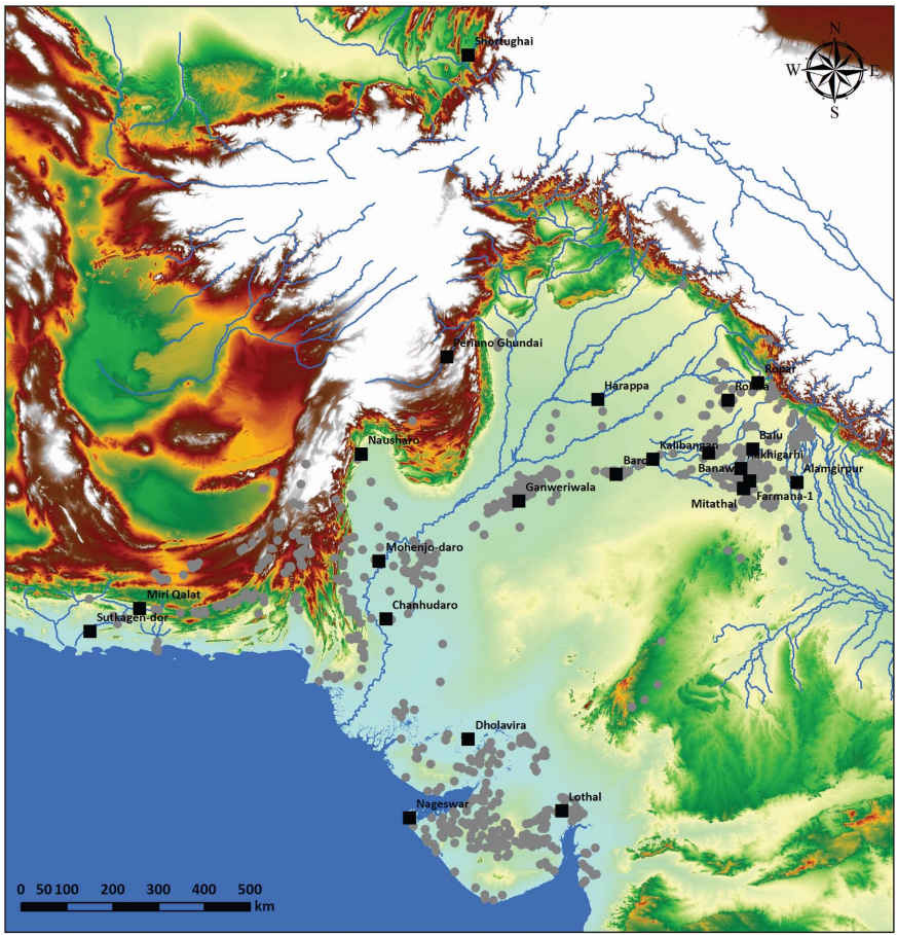

Fig. 6.1 Map showing the extent of Indus civilisation (Courtesy: Akinori Uesugi)

Over the years, a variety of terminology has been developed to describe the cultural and historical sequence of the Indus civilisation. At present, the most common terms for the periods between *circa* 4000 and 1500 BCE are the 'pre-Indus' or 'early-Indus', 'mature-Indus', and the 'late-Indus'. In order to eliminate the confusion created by these terms, Possehl came out with an alternative terminology and used the terms 'preurban', 'urban' and 'post-urban', based on the socio-cultural and technological developments recognised at different stages of the Indus occupation (Possehl 1992: 118). However, Shaffer suggested four distinct eras for the Indus Valley tradition: (1) early food-producing era, (2) regionalisation era, (3) integration era and (4) localisation era. Within each era, a number of phases have been defined, but he retained the aforementioned most common terms (Shaffer 1992: 442).

The early formative phase of the Indus civilisation is generally known as the ‘pre-Indus’ or ‘early-Indus’ phase. During that phase, the inhabitants of the Indus Valley and the neighbouring areas were organised into several regional cultures, which not only provided the prerequisites for the rise of a complex urban state, but also provided a stable base for the emergence of the Indus urbanism. In the ‘mature-Indus’ (urban Indus) phase, most of the regional cultures of the greater Indus Valley and neighbouring regions were integrated into a geographically larger urban society (Shaffer 1992: 448450). The ‘mature-Indus’ phase is generally associated with large settlements, monumental architecture, long-distance trade, craft specialization and class hierarchy, and so on. That phase is also known for its uniformity and standardisation in weights, measures, ceramics, architecture, and in other arts and crafts. As has been pointed out by Agrawal, there was expression of local religious beliefs and traditions, which was due to the visible mobility and growth of the Indus civilisation over a large area consisting of a number of ecozones with diverse environmental variables and economic incentives (Agrawal 2007: 63).

The transition from the ‘early-Indus’ phase to the ‘mature-Indus’ phase has been a topic of considerable discussion. Some scholars feel that the transition occurred over 100-150 years, while to others it was a gradual and long process. Radiocarbon determinations place that phase into a bracket of *c.* 2550-2000 BCE, though the end of the ‘mature-Indus’ phase is debatable. Possiblly, that could have continued up to 1900 BCE. A decline in urban life, a gradual deterioration in the material culture and more regional expressions of the Indus traits marked the end of ‘mature-Indus’ phase. The outcome of that process led to the emergence of a heterogeneous stage of the Indus culture, commonly referred to as the ‘late-Indus’ or the ‘post-urban Indus’. During that ‘late-Indus’ phase, the previously integrated regions of the Indus civilisation broke into different localised cultures.

It is now more or less clear that the ‘late-Indus’ people occupied a distinct place in the archaeological sequence of Haryana, Punjab, Sindh, Gujarat, western part of Uttar Pradesh, northern Rajasthan and northern Deccan, with the regional variations in pottery and other cultural traits. The causes responsible for decline of the Indus civilisation, the degradation of its material culture and urbanism, were too many, but those are still to be properly understood and evaluated.

While the archaeological evidence clearly point towards a complex and highly integrated urbanised society, the Indus civilisation lacked certain features, like social stratification and institutionalised authority that the other early civilisations demonstrated. Unlike the neighbouring

civilisations in Mesopotamia and the Nile, the elites of the Indus civilisation do not appear to have constructed clearly identifiable palaces, temples and royal tombs. With the exception of a few cases, the Indus graves were full of only clay pots. Its statuary was of the smaller sizes and it did not reveal the evidence of life-sized statues. The decipherment of Indus script probably would have provided a direct access to the political ideology and social organisation of the Indus civilisation, but that script is still undeciphered. Over the years, many have tried deciphering that, but not a single effort has so far been accepted by the scholarly community. Some recent researches have even suggested that the Indus script is just a system of written symbols, and not a script at all. The problem is that most of the evidence of the Indus script has survived in the form of small stamp seals or in the form of graffiti on pottery. In addition, there is neither narrative pictorial description nor does the earliest of the subcontinent's historical literature contain a direct reference to the Indus civilisation. The civilisation is also lacking the evidence to suggest an organised warfare or any other form of violent incident. It is with this realisation that many researchers have returned to the material remains as well as re-examination of the previously collected data to provide a more reliable database for a better understanding of the Indus civilisation.

Animal Husbandry

The animal husbandry among the Indus people revolved around the domestic animals, such as cattle, buffalo, sheep, goat and pig. However, the Indus faunal economy was characterised by a large-scale use of cattle. The bones of cattle constitute half or three-fourth of what has been found in the Indus sites in Gujarat. Nevertheless, the relative quantity of bones of those animals varies not only form site to site, but also between the different spatial areas of the same site. 'The large-scale use of cattle was the culmination of a trend set in motion at Mehrgarh II, and continuing in the intervening period, not only at Mehrgarh itself, but also at certain 'pre-Indus' and 'early-Indus' sites in Pakistan' (Chattopadhyaya 2002: 392).

Cattle

The zebu cattle (*Bos indicus*) were the main domestic animals of the Indus people, besides the humpless cattle (the taurine cattle, *Bos taurus*) might also have been kept, as may be inferred from many humpless 'taurine' cattle figurines and the steatite humpless bulls that have been recovered from the Indus sites. (**Fig. 6.2**) Furthermore, the

depiction of so-called ‘unicorn’ on the Indus seals is often identified as a representation of the humpless bull. (**Fig. 6.3**) (**Fig. 6.4**) However, the presence of so much imagery of humpless cattle during the ‘mature-Indus’ phase, against the absence of osteological evidence, is still an enigma of the Indus archaeozoology. While osteological remains of *Bos indicus* and *Bos taurus* are difficult to differentiate (except, if the spina bifida is found), there is genetic evidence of the spread of taurine cattle eastwards to the Indus Valley by the third millennium BCE (Kumar et al. 2003: 49). (**Fig. 6.5**)

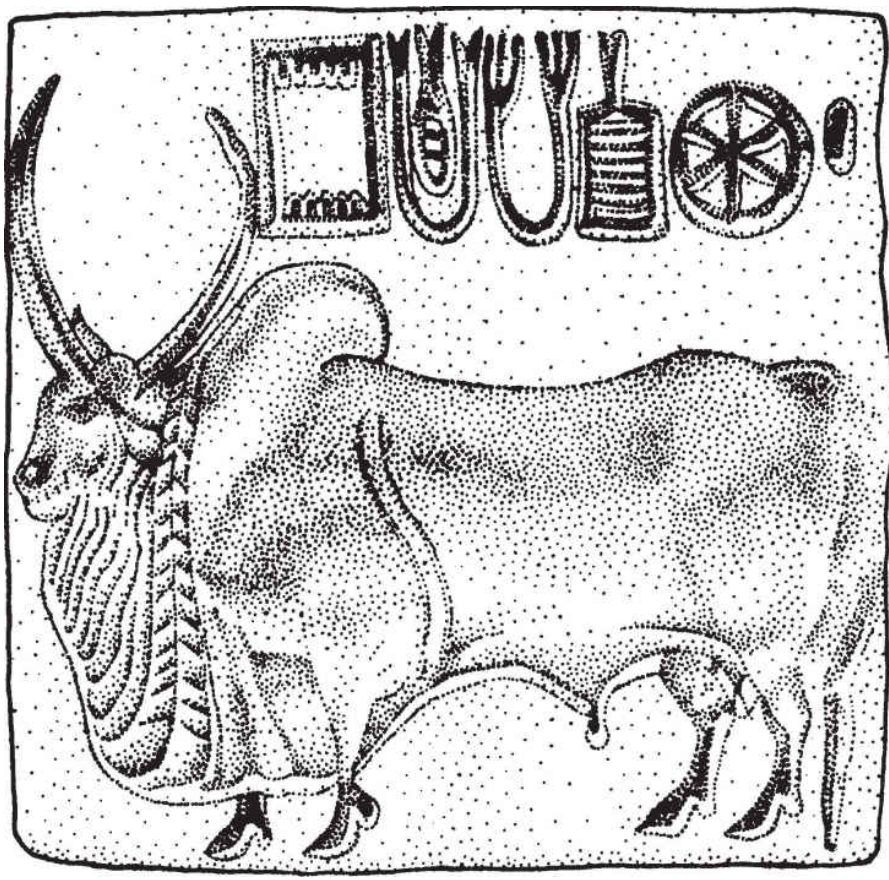

Fig. 6.2 Seal with a zebu bull (Courtesy: Late G. L. Possehl)

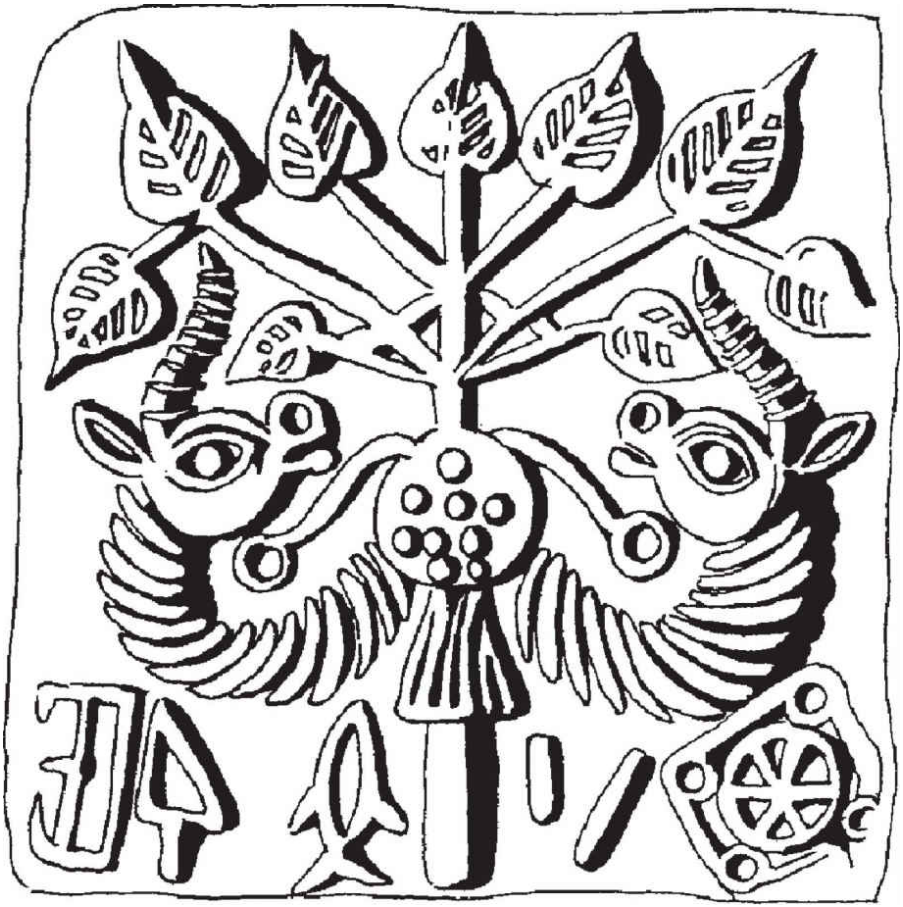

Fig. 6.3 Unicorn depiction on a Indus seal (Courtesy: Late G. L. Possehl)

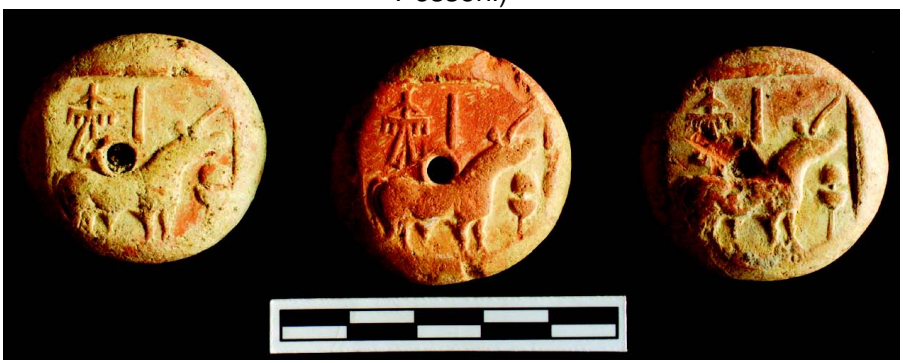

Fig. 6.4 Seal impressions depicting unicorn (Courtesy: J. S. Kharakwal)

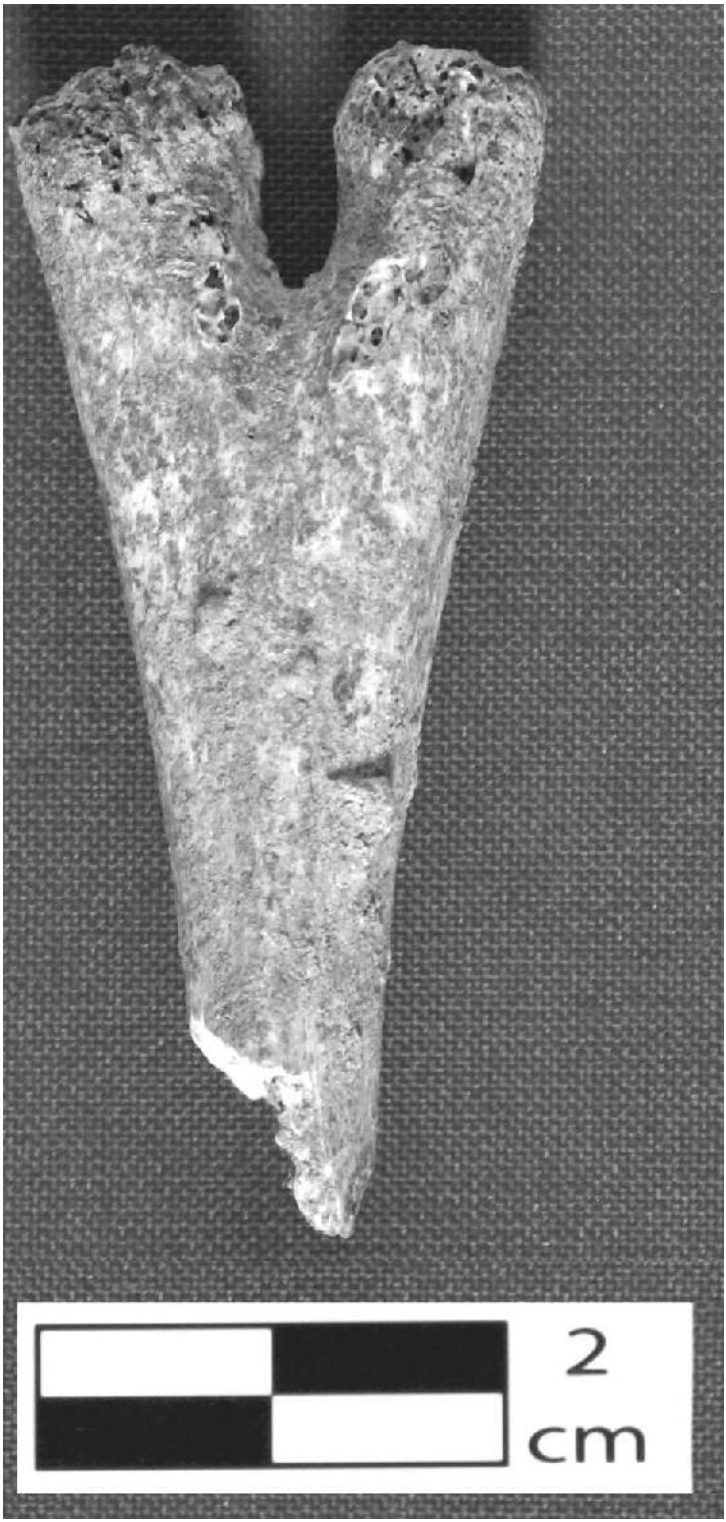

Fig. 6.5
Evidence of humped cattle, spina bifida

As already stated, the skeletal remains of cattle dominate the Indus faunal assemblages, and quite often account for more than 60 percent of total skeletal fragments. Many of the cattle bones recovered from Indus sites bear butchery marks, and those are often burnt. That shows that the Indus people obtained a significant amount of animal protein from cattle. However, cattle were not only used as the source of food as meat, but had many other uses, like traction, within the Indus economy. The by-products of those, like milk, were also of the economic importance. While there is no direct evidence related to the dairying activities in Indus sites, faunal patterns in a number of Indus sites are consistent with the dairy activities. The mortality profiles of cattle have been used to indicate the use of milk at the Indus sites of Kuntasi, Rojdi, and Shikarpur. More recently, faunal analysis conducted at the Indus sites of Kanmer and Bagasra have thrown light on the evidence related to the dairying activities at those sites (Goyal et al. 2013: 141-150; Chase 2010: 528-543). The basic faunal methodology employed in those analyses was based on sex and age of animals on death.

However, Laura J. Miller comprehensively studied the use of cattle's milk and other milk products, such as cheese, yoghurt and butter and so on during the Indus civilisation in her Ph.D. dissertation and found that those were the important components of the Indus subsistence economy. She adopted multidisciplinary methodologies (ethnoarchaeological, artefact analysis and archaeozoological) to document dairying activities at the site of Harappa. Her analysis revealed the presence of a large numbers of older adult female (+7 years) at the site. The presence of such a large number of adult female animals showed that dairying activities were an important part of the subsistence activities. Those cattle might have been killed for meat after the decline in the milk yield. She also reported the presence of immature cattle in assemblage. It further supports the presence of dairy activities at the site, as yearly production of calves is necessary for initiating lactation in cows. To support that archaeozoological data, Miller also tried to identify the potential dairy vessels at Harappa that might have been used during the Indus times, to know about the similarity of those to the modern dairy vessels. Previously, Gouin also studied the similarity of the potential ceramic vessels from the Indus site of Nausharo and identified graters, strainers and other storage forms that he believed were used in a large-scale dairy industry (Gouin 1992: 143-149). The residue analysis of ceramic vessels was also done to document the use of those for milk storage and processing. For instance, based on the presence of lipid residues in a perforated vessel at Nausharo, Bourgeois and Gouin suggested that dairy

products, like ghee or cheese were produced at the site (Bourgeois and Gouin 1995: 125-128).

While the time and origins of the use of dairy products in South Asia are uncertain, it may be suggested that the dairy technologies began just after or simultaneously with the initial domestication. Miller's study at Harappa has already shown that dairying activities were important at the site from the earliest Ravi phase occupation (a regional sub-phase of the larger Hakra phase) onwards. That phase can be dated to 3700-3500 BCE (Kenoyer 2009: 1-34). Since Mehrgarh has the earliest evidence for cattle domestication, that would be an interesting place to explore the origin of milk usage, which probably occurred sometime after (or concurrent with) initial animal domestication.

Cattle were also used to pull carts and ploughs, both of which are well documented in the terracotta models. (**Figs. 6.6 and 6.7**) However, there are far more evidence of transport traction than just agricultural traction. The evidence for agricultural traction comes from the three terracotta models of plough recovered from the sites of Banawali, Qasimwala and Jawaiwala Ther. (**Fig. 6.8**) In addition, two complete terracotta yokes have been recovered from Nausharo. Furthermore, the unique evidence of a ploughed field (with furrows at right angles to each other) was discovered just outside the town walls, dating to the 'early-Indus' period at the site of Kalibangan. (**Fig. 6.9**) While the artefactual evidence for agricultural traction is rare, a large number of terracotta models of the wheeled vehicles and wheels, used in transportation activities, have been recovered from almost every 'mature-Indus' site. Carts are further documented by ruts in ancient streets at Harappa and Farmana. There is also evidence for traffic wearing away the walls of buildings at Mohenjodaro. Transport has been one of the most important activities of trade, without it there could have been no town and cities. Therefore, transportation may have been one of the basic instruments of the Indus civilisation.

Fig. 6.6 Bullocks used for agricultural operation

Fig. 6.7 Bullocks used for pulling carts

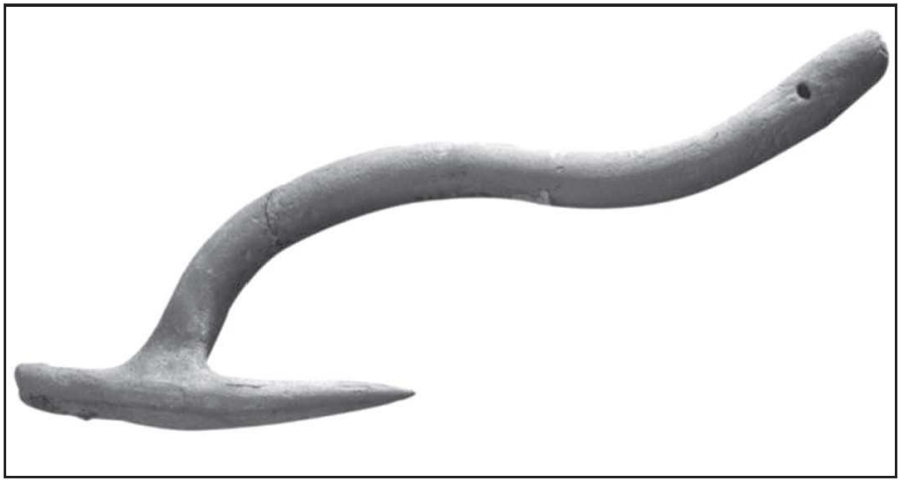

Fig. 6.8 Plough from Banawali (courtesy: R.S. Bisht)

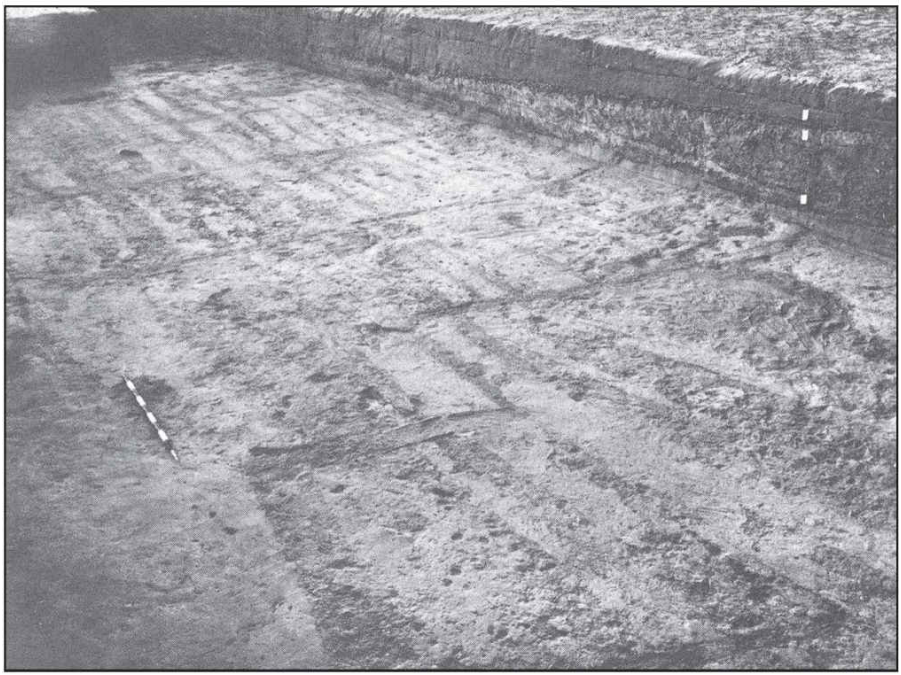

Fig. 6.9 Ploughed field from Kalibanga (After J. P. Joshi)

Significant faunal researches related to the use of cattle for traction has also been undertaken at several Indus sites. Faunal analysis conducted at Harappa, Kanmer, Bagasra, Kuntasi, Rojdi, Shikarpur and Dholavira have all evidenced use of cattle for traction. The size differences in cattle populations at Harappa and Nausharo might indicate different regional domestic breeds (Meadow 1991: 89-106). That, in a way, suggests that separate breeds of cattle were kept for secondary products (dairy or traction). The question about the origin of draught use of cattle in South Asia is difficult to answer at this point.

The discovery of a possible cart fragment on a well-preserved house floor from the Ravi phase at Harappa should be taken as evidence for the beginning of experimenting with the cart technology around 3700-3500 BCE (Kenoyer 2009: 1-34). However, the actual use of cattle as a draft animal may have begun at an earlier date, sometime soon after it was domesticated. Again, Mehrgarh will be an ideal place to explore that issue.

Cattle were also valued for hide, dung and bone. While there is no direct evidence for the use of cattle hides at any of the Indus sites, the ratio of the first, second and third phalanges (bones of the fingers or toes) of animals can be used as an indirect evidence to throw light on the utilisation of animal hide. It is generally assumed that while removing the hide of an animal, the third phalanx (last bone of the finger or toe) is also removed. The ratios of different phalanges can be interpreted as the per cent loss, if one assumes that the first and second phalanx form one butchering unit. That per cent loss can be used as an indirect evidence of the use of hide at any archaeological site. To find out the use of hide, Joglekar used that method at the chalcolithic sites of Kaothe and Walki, and Pawankar adopted a similar approach at the chalcolithic site of Inamgaon. Their analysis revealed the highly probable use of hide of cattle, sheep and goats. Goyal made similar attempt at the Indus site of Kanmer for his Ph. D. dissertation. The ratios calculated for cattle/buffalo specimens revealed a significant loss of third phalanges during the ‘mature-Indus’ and ‘late-Indus’ phases at Kanmer. Additionally, the evidence of skinning has also been noticed from the skinning marks on the first and second phalanges of those animals. All those evidence together suggest the use of cattle hide at the Indus site of Kanmer.

Cattle were undoubtedly the mainstay of Indus economy. However, cattle represented far more than meat, milk, traction or hide. The mechanisms, through which they were managed, distributed, processed and eaten, might have been often complex and linked inextricably to the socio-political structure of that time. According to Possehl, ‘…it is fair to say that cattle were more than likely a prominent form of wealth for those people and must, therefore, have been a source of great prestige’ (Possehl 1999: 177).

Sheep and Goats

Although cattle were the principle domestic animals of the Indus people, they also kept sheep and goats. In fact, those animals were the second-most important animals in the Indus economy after cattle. The bones of those animals are common in the faunal collections from

virtually every Indus site. In addition, terracotta figurines of sheep and goats have also been reported from the Indus sites. Furthermore, goat or a goat-like creature has been recorded on several Indus seals and sealings. It clearly shows that sheep and goats played an important role in the Indus subsistence economy, even so the focus of research has generally been on the cattle for two reasons. First, the cattle had more numerous in Indus sites, and secondly, that a single cow provides much more meat, or in the case of secondary products, more milk or traction power.

Nevertheless, the above discussion leads to a series of interesting questions. How significant was the contribution of sheep and goats to the stock raising activity during the Indus period? What was the role of sheep and goats in the overall herding strategies of the Indus civilisation? Were sheep and goats kept primarily for meat or also for dairy products and wool? Sheep and goats were certainly kept for meat and perhaps for milk. Sheep were probably also kept for wool. However, no direct evidence for the use of milk and wool has been available. While there are both, pictorial and documentary, evidence of woolly sheep and woollen textiles from the late fourth millennium BCE onwards in Mesopotamia, such evidence is missing from the Indus context. Therefore, one has to depend on the indirect evidence (the faunal patterns at different Indus sites) to document the use of secondary products of those animals.

The archaeological evidence suggests that the role of sheep and goat varied regionally, but generally that was far less central than that of cattle. A look into the different Indus faunal assemblages shows that goats were generally kept in far larger number than sheep. However, there are some exceptions. For example, the remains sheep greatly outnumber those of the goats at the site of Harappa. In addition, those sheep were markedly large-bodied (Meadow 1991: 89-106). The slaughter profile that he worked out for sheep also indicated high proportion of adult animals in Harappa's faunal assemblage. That evidence, when combined together, suggest that selective breeding of sheep was taking place at the Harappan site perhaps for the secondary products (wool). In contrast to Harappa, a relatively balanced sheep-goat ratio has been recorded at the Dholavira and Nausharo sites. The goat's ability to browse on a wider range of plants and survive in difficult terrains has been proposed to explain a relatively even ratio of sheep-goat at those sites, which are located in a relatively arid environment (Patel 1997: 101-113). However, it is important to note that there are slightly more sheep present in the sites of Dholavira and Nausharo. Therefore, it is probable that the emphasis on sheep at those sites also may be related directly to secondary

product economies (milk or wool). It is fair to say that the secondary products (dairy, fibre and lighter traction) of sheep and goats were also vital to the subsistence activities of the Indus people. The management strategies for sheep and goat might have been different from those adopted for cattle, for those depended not only on the variable ecological conditions in different regions, but also on the culturally conditioned food preferences and the social and economic motivations, as those played an important role in decision-making processes (Miller 2003: 250-325). (**Fig. 6.10**)

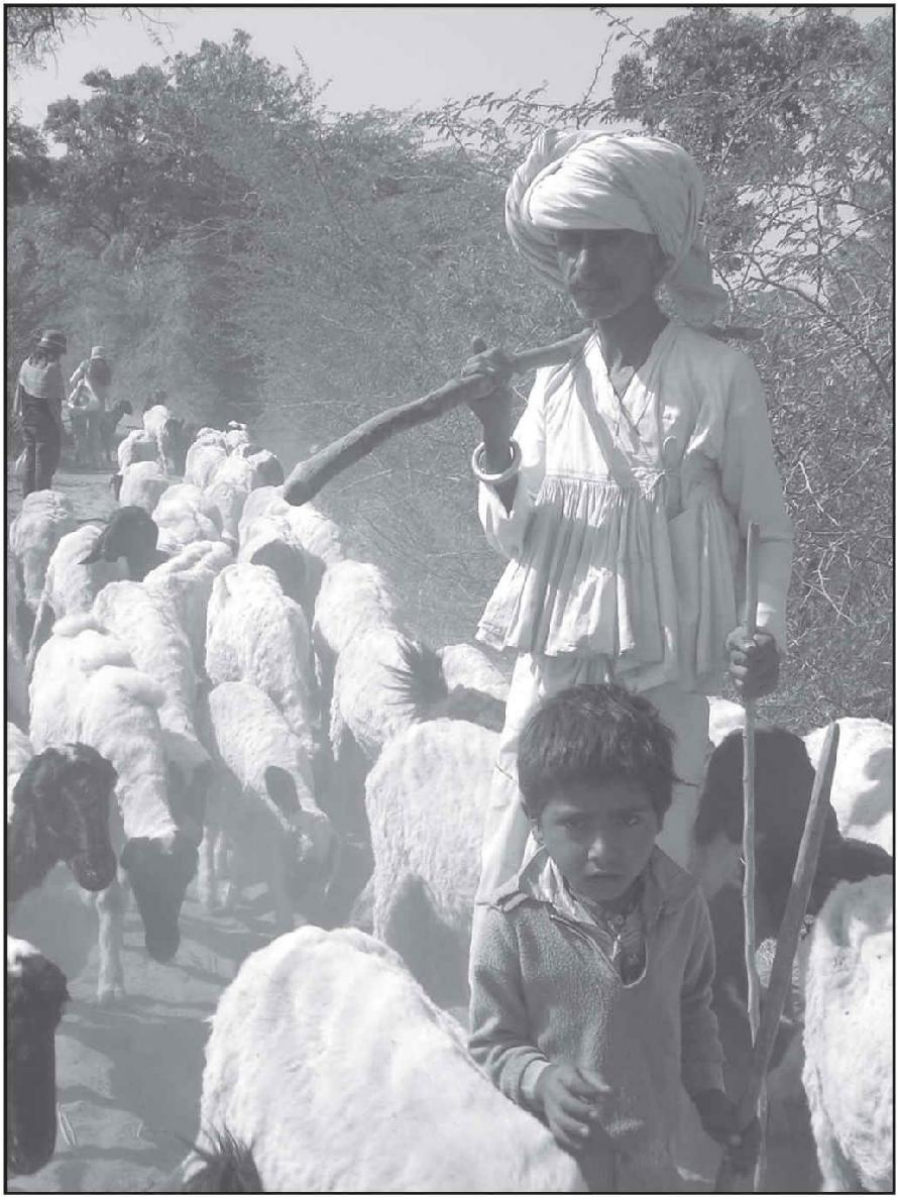

Fig. 6.10 Sheep pastoralism

Buffalo

There are a number of iconographic representations of buffalo from the Indus sites. (**Fig. 6.11**) Human images wearing buffalo horn-dresses are also common. However, compared to the cattle and sheep/ goats, the physical remains of buffalo are scarce in the Indus assemblages. The only exception is the Dholavira site, where Patel found an abundance of domestic buffalo in the 'mature-Indus' period. One of the main reasons for the scarcety of buffalo remains in the Indus sites may be the difficulty to separate the skeletal elements of buffalo from those of the cattle. Those two species so closely resemble each other that it is difficult to assign a bone, when it is fragmented or has no distinguishing markers, to a particular species. Therefore, in most of the cases, broad-level groups, like cattle/ buffalo are commonly used. Consequently, the economic contribution of buffalo to the Indus subsistence system is not clear.

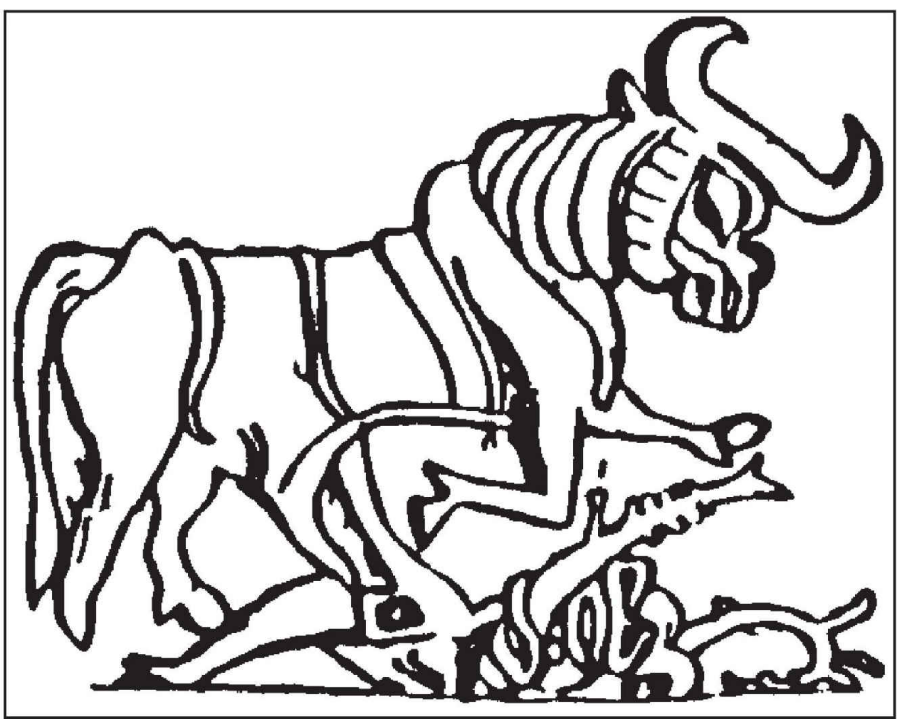

Fig. 6.11 Buffalo depiction on a Indus seal (Courtesy: Late G. L. Possehl)

The presence of both wild and domestic buffalo at the Dholavira site suggests that those animals were not only being hunted, but also

managed as the domestic animals during the Indus period. However, the presence of such a large number of buffalo at Dholavira (located in an arid environment) is surprising. As stated in Chapter 3, buffaloes need to be near the water source. This need might have been fulfilled through immersion in the large water reservoirs that have been discovered at the site (Patel 1997: 111). Nevertheless, that does not explain the presence of a very small number of buffaloes at the Harappan site, which has a more suitable environment for buffalo keeping. On the scarcity of buffalo bones at the Harappan site, Laura J. Miller in her Ph. D. dissertation, says,

> The fact that buffalo are not found at Harappa in great numbers, suggests domestic buffalo may not have locally available or were deliberately not exploited by Harappan residents. It is possible that wild buffalos were not as prevalent in the regions around Harappa, reducing their potential for contributions (in either wild or domestic forms) to subsistence economies at Harappa…. Whatever the reason behind the animal choice, the scarcity of buffalo at Harappa indicates that there was significant regional variation in urban subsistence strategies during the Urban Harappan period, suggesting different economic system and urban economic trajectories.
>
> *Laura J. Miller*

The water buffalo is a prolific producer of milk, with a very high milk fat contents when compared to that of the cow. Therefore, those animals might have been kept primarily for dairy production during the Indus period. In addition, those animals might have provided meat as well as traction. While the use of cattle for traction is now more common, buffalo is still used for such purposes in many parts of the modern India. (**Fig. 6.12**) Buffalo dung may also have been valued as either a fuel or manure.

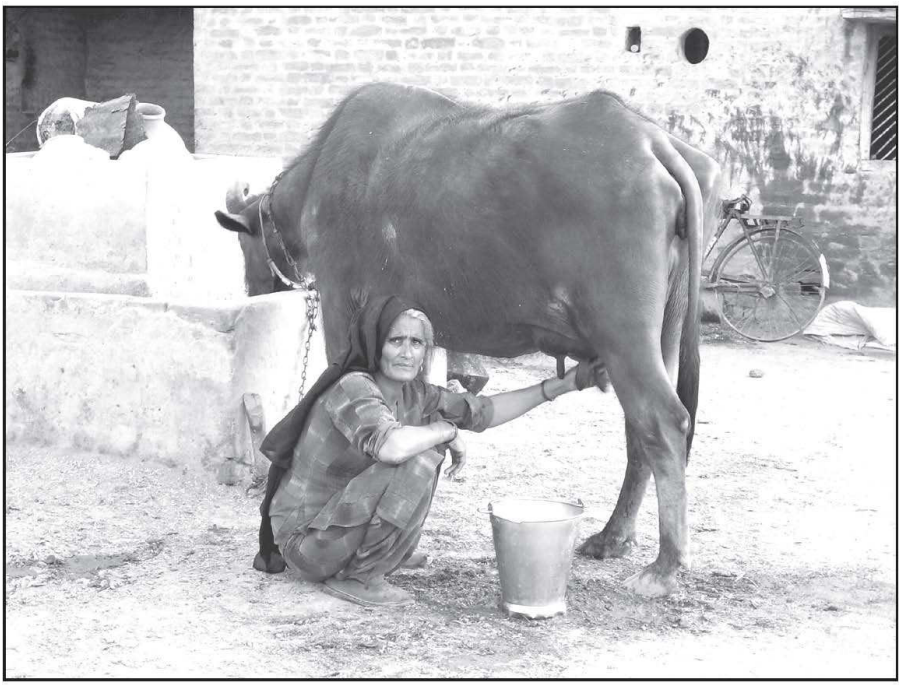

Fig. 6.12 Buffalo as a source of dairy industry

Pig

As we have seen in Chapter 3, pigs and humans have a long history of interaction. The recent research into the modern pig genetics has provided compelling evidence that appear to support the 'multiple domestication' hypothesis.

Both domestic and wild pigs have been reported from many Indus sites. However, the domestic status of pig during the Indus culture has not been well understood. Pigs can out-produce other livestock in terms of number of offspring and meat per individual; and their meat has the highest fat and calorific content of any domesticate. Therefore, pigs are generally slaughtered at an early age in modern times. As predominantly meat-producers, these are killed on reaching full size. Hence, changes in the mortality curves are regarded as one of the main criteria used in the identification of domestic and wild pigs. Based on the relatively larger proportion of adult animals at Dholavira, those were tentatively identified as the wild pigs (Patel 1997: 108-110). Similarly, as compared to adult pigs at Bagasra, presence of a large number of smaller ones was recorded, which led to believe that the domestic pigs were present at that site (Chase 2010: 528-543). However, the representation of more adult animals or small animals should not be the sole criteria for judging the domestic or wild status of

pigs, because there are a number of problems with this approach, which Albarella et al. have elaborated. Those are summarised hereunder:

- Growth is quicker in modern animals than in the traditional, unimproved breeds. Hence, slaughtering of domestic pigs at an early age is a recent phenomenon, as the improved fast-growing breeds did not become common until the late medieval or even early modern times.
- While hunting wild animals, more young animals are killed. Such a hunting pattern was especially likely when the pressure on the wild resources was probably quite heavy.
- Seasonality of hunting may also affect the age pattern. Wild boars have quite large litters and that fecundity means that many very juvenile animals are encountered shortly after the breeding season (Albarella et al. 2006: 217-218).

Therefore, metrical and morphological criteria should also be taken into consideration, along with the kill off pattern to separate wild and domestic pigs.

It may also be noted that the representation of pigs in the faunal assemblages from a large number of Indus sites is low. Apparently, the low status communities in urban settings maintain and raise pigs, as is the case in the northern India today. Pigs are known to trample and uproot cereal grains if allowed to venture into cultivated fields, and the physiological attributes of this animal militate against the kind of long distance movement that has been so successfully used in the management of other domestic animals. Moreover, pigs also do not provide renewable resources, like milk, wool, hair, labour, and so on. Probably, those were some of the reasons, which are represented in the form of low percentage of pigs in the faunal assemblage. However, there is need to study the status of pigs more systematically to understand the human-pig interactions in the Indian subcontinent in an objective manner.

Other Domestic Animals

Horse and Ass

Whether the horse was known to the Indus people, has long been a cause a contentious issue among scholars. Its presence or absence in the Indus civilisation is so serious a matter that it has generated debates and acquired some political overtones. Horse bones have been reported at a few Indus sites, such as Mohenjodaro, Harappa, Ropar, Kalibangan, Lothal, Kuntasi, Surkotada and Shikarpur, besides at the Malvan and Kanewal sites of the late phase of Indus culture. The bones of domestic ass have been reported from a number of Indus sites, including Kalibangan, Rangpur, Surkotada, Kuntasi and Harappa, among others. In a slightly later context, the horse and ass have been identified at Pirak (a site of the second millennium BCE), located closely to the Mehrgarh and Nausharo sites. However, the association of horse bones with the 'mature-Indus' period, especially its remains from the site of Surkotada, are questioned by Meadow and Patel (1997: 308-315), despite the fact that Sharma identified horse bones from all the phases (IA, IB and IC) of the Indus occupation at Surkotada (Sharma 1990a: 381). Later on, Bökönyi carried out a thorough examination of the equid bones found at Surkotada and fully endorsed the identifications of Sharma (Bökönyi 1997: 298-299). Meadow and Patel in a rejoinder to Bökönyi challenged his identifications. They argued that not even one clear example of horse bones came from the Indus excavations or elsewhere in north India before 2000 BCE (Meadow and Patel 1997: 308-315). Unfortunately, Bökönyi passed away before he could give his final response.

The debate on the presence of horse bones in the Indus contexts has three main points. The first point deals with the ability to distinguish the horse from its closely related species. Even with the well-represented taxa in the Indus sites, there may be considerable difficulties in the identification and characterisation between the closely related forms, such as cattle or buffalo and sheep or goat. For equids, the situation is even more complicated when there are three possible species, like *Equus caballus* (horse), *Equus asinus* (donkey) and *Equus heminous* (onager). (**Figs. 6.13** and **6.14**) Beside, the horses and donkeys can interbreed to produce hybrid animals (mule or hinny). Therefore, it is rather difficult to make a precise identification from the scarce and fragmentary remains of those animals from the archaeological sites. Although, there are differences among those closely related species,

but that requires skill and good comparative material to determine them. Joglekar states that '… the debates would continue until a comprehensive key of identification is worked out, made available to all those interested in the subject and the 'horse' and 'wild ass' remains from all the sites are examined again' (Joglekar 2006: 41)

Fig. 6.13 Wild ass from Kachchh, Gujarat

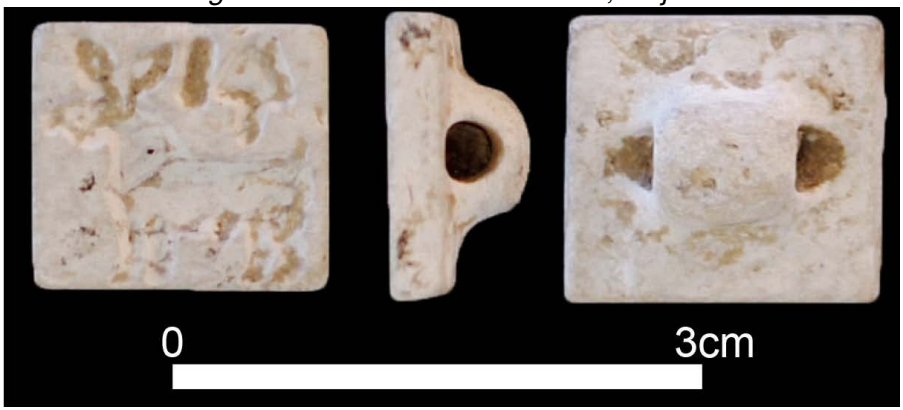

Fig. 6.14 Wild ass depicted on a seal from Kanmer, Gujarat (Courtesy: J. S. Kharakwal)

The second point of the debate is associated with the contextual and stratigraphic details of horse bones recovered from the Indus contexts. Often, the contextual integrity of the horse remains reported from Indus sites is questioned in the absence of detailed discussion on the archaeology of those finds. Identifications, no matter how firm, are not particularly useful, if the bones on which they are based come from poorly defined contexts (Meadow and Patel 1997: 309, 401).

The third point of the debate is related to what role the horse could

have played in the Indus culture, if we accept the published information. If we look at the ubiquity of the identified horse remains (and accept the evidence), it seems that the horses were present at coastal sites, such as Shikarpur, Surkotada and Kuntasi. There is a possibility that the horses might have played some role at those sites, which could have been trading posts or important stations during the Indus period.

Terracotta figurines of horse are also said to be present at Mohenjodaro, Lothal and Rangpur. However, that evidence is even more difficult to apply to distinguish the closely related species. Bökönyi points out that the wild horses did not exist in the post-Pleistocene times in India, and so it could not be domesticated locally (Bökönyi 1997: 297). Therefore, the horse had to be introduced in an already domesticated form from the area where early domestication of those animals had taken place (Thomas 2002: 411-412). However, it may not be surprising that the horse was introduced into the Indus civilisation from Central Asia and the animal existed in certain pockets of the vast Indus territory (Chattopadhyaya 2002: 397). Towards the later phase of Indus culture, the horse not only made its presence felt, but also become widespread. After considering all of the aforementioned aspects, it becomes clear than the subject deserves more serious and systematic treatment than it has so far received.

Camel

As mentioned in Chapter 3, there are two species of camels found in the Old World— the one-humped dromedary (*Camelus dromedarius*) and the two-humped Bactrian camel (*Camelus bactrianus*). Camels are extremely useful for riding upon and doing heavy-duty labour of pulling carts. In addition, camel milk and flesh are also is consumed. Since camels can tolerate aridity, these have the capacity to go for long intervals without water. (**Fig. 6.15**)

Fig. 6.15 Camel used as pack animal

Camel bones have been reported from Mohenjodaro, Harappa, Surkotada, Kanewal, Kalibangan, Nagwada and possibly Rojdi. Evidence from Mohenjodaro also includes a complete camel skeleton excavated by Wheeler in 1950 (Meadow 1984: 133-139). The camel was an important animal for the overland trade during the Indus times (Shaffer 1988: 1315-1328), yet, as with the horse, the association of camel with the 'mature-Indus' phase is also questionable. Most of the camel bones have been recovered either from the upper levels or from the doubtful stratigraphic contexts. Having discussed the evidence of camel in the Indus sites, Sathe and Atre hold that 'Indus people did not use camel although they might have known it by their contacts with the west' (Sathe and Atre 1989: 305). However, Possehl questions that statement, given the range of Indus sites with camel bones (Possehl 1999: 196). Obviously, camel and its Harappan association is a contentious issues that can only be resolved by the excavations that

may yield more camel remains from the secure stratigraphic contexts. Another debated issue is to find whether the camel was the dromedary or the Bactrian type. It is possible now to make qualitative distinctions between the *Camelus dromedarius* and *Camelus bactrianus* in the laboratory with a fresh look at all skeletal camel remains.

Dog and Cat

Bones of the domestic dogs have been identified at a number of Indus sites. In addition, a number of dog figurines have been recovered from those sites. (**Fig. 6.16**) Collars are shown around some of the figurines, making the case for their domestic status stronger. Mackay identified several breeds of dogs from the figurines excavated from Mohenjodaro (Mackay 1937-38: 286). His identification included a squat animal resembling a bulldog, a rangy beast like an Afghan hound, one with pointed hair, and a fourth having an upright tail. Likewise, Rao tentatively identified three breeds: the common pariah dog, the mastiff and the hound at Lothal (Rao 1985: 482). A brick from Chanhudaro provides interesting evidence regarding a dog chasing a cat. That brick bears impressions of the paws of a dog and a cat. In his discussion of those foot imprints, Mackay quotes from a letter by Dr. Glover M. Allen, who examined the object, ‘Here then is a record of a prehistoric dog chasing a large prehistoric cat, the dog’s imprints slightly overlapping the cat’s shows that he came second’ (Mackay 1943: 222).

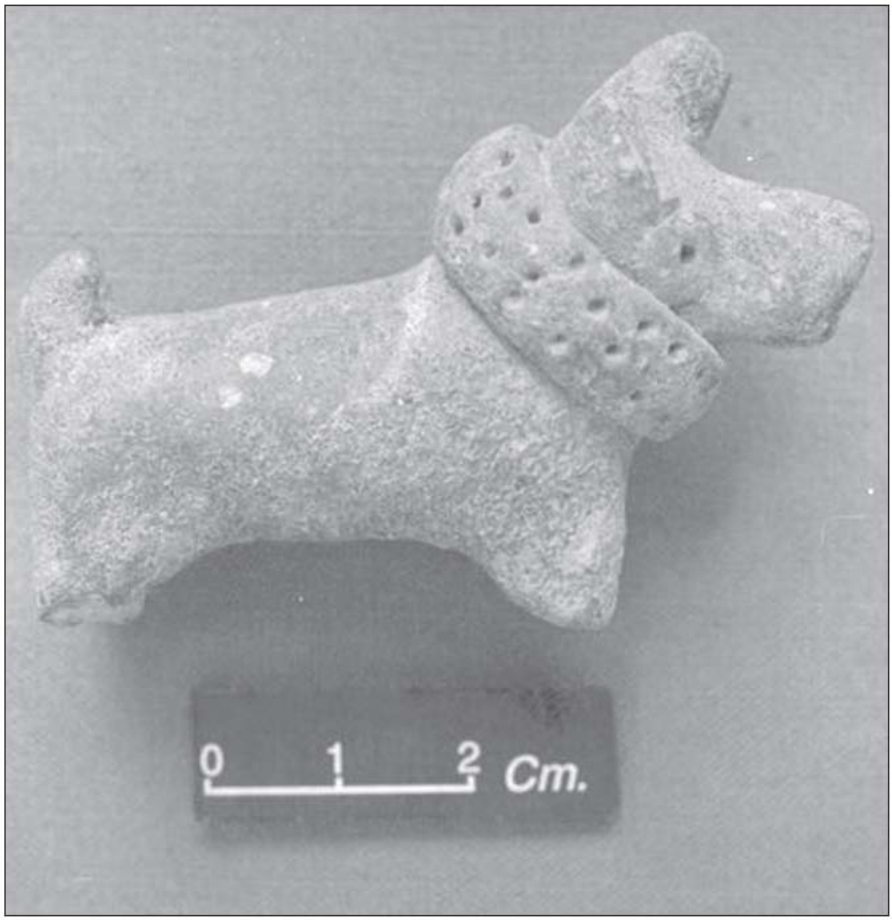

Fig. 6.16 Terracotta dog figurine from Rakhigarhi (After Amerandra Nath)

The bones of domesticated cats have also been identified from a number of Indus sites, including Harappa, Jaidak, Shikarpur, Rojdi, Kanmer and many others, but no artistic representation of the cat has so far been recovered from the Indus sites.

At none of the Indus sites or the cultural phases is there any evidence of the consumption of dogs and cats. No trace of human activity pertaining to the eating of dog and cat flesh has shown up, except at Kanmer, where charring of some cat bones was indicated. However, that charring also did not seem to be due to human action, but to some sort of accidental fire. There might have been a variety of reasons for keeping those animals. As for instance, dogs might have helped in keeping watch over the fields and homes, and in the hunting pursuits of the Indus people. Similarly, domestic cats might have been valued as pet animals by the agricultural communities for controlling rodents.

However, none of those animals had direct economic significance. Additionally, keeping pets, like dogs and cats can also be related to the social differentiation in complex societies. For instance, many people keep dogs and cats for symbolic purposes, to advertise their status and prestige in the modern societies. Those animals are employed as living adornments and even as the animated plaything or toys.

Domestic Fowl

The skeletal elements of chicken have been reported from a large number of Indus sites. In addition, some terracotta figurines are also thought to represent chickens. However, many of those are not true depictions of the domestic fowl. Mackay reported a figurine of bird with a feeding container in front of it, which he believed to be representing a tame fowl. As stated in Chapter 3, recent genetic studies have suggested multiple origins of domestic fowls in the South Asia and Southeast Asia, which may strengthen the possibility that the Indian chickens were locally domesticated.

Wild Mammals, Birds and Reptiles

Although the contribution of wild mammals, birds and reptiles to the Indus food economy was much less in comparison to that of the domestic animals, yet those animals played an important role in the Indus subsistence activities. Important wild mammalian species that the Indus people exploited include wild boar, wild ass, deer species (sambar, *barasingha*, spotted deer, hog deer and mouse deer), the antelopes (nilgai, blackbuck, *chinkara* and four-horned antelope), and smaller mammals (hare, mongoose and porcupine), and so on. Of those, the commonly hunted were the blackbuck, *chinkara*, spotted deer, nilgai, wild boar and hare. While the presence of burning and cut marks on the bones of those animals indicate that those were an important part of diet of the Indus people, but the depiction of those animals in the Indus art is rare. The Variation noticed in the relative abundance of wild animal bones is related to the location of the Harappan sites.

Possibly, certain species were attracted towards a particular site because of their sparse population, different hunting methods and preferences, different crop cultivation practices or beliefs among the different Indus communities that attracted certain species towards a particular site. While, the Indus people might have hunted some of those animals, the hunter-gatherers also might have supplied those, which aspect are discussed in a separate section. Besides meat, those animals might have provided such products that were unavailable from the domestic livestock, such as fur for making clothes and antlers for making tools. Antler is also known for its medicinal use. Boar tusks might have used as a type of ivory and boar bristles are used for making fine brushes. Porcupine quills might have been used as piercing instruments. These also have been used as stylus.

Another animal that the Indus people possibly exploited is the gaur (*Bos gaurus*) or the Indian bison. It is a massive animal with a distinctive ridge down the centre of its shoulder area. Wild gaurs now inhibit the hilly regions of peninsular India, but in antiquity, these probably extended into the Indus Valley. Osteological remains of that animal have probably been reported from the Indus sites. It is suggested that the ‘short-horned’ cattle depicted on Indus seals is a gaur (Mackay 1937-38). The equation of short-horned bull with the gaur is reasonable even in the absence of any example, because the distinctive ridge at the shoulder is shown in a convincing way (Possehl

1999: 184). It seems that the wild water buffalo (*Bubalus arnee*) was also hunted during the Indus times. The bones of that animal have been reported from the Kuntasi and Shikarpur sites (Thomas et al. 1996: 297-330; 1995b: 33-42). In addition, a number of Indus seals that depict people combating an aggressive buffalo, which may be a wild water buffalo.

The bones of elephant and rhinoceros have also been recovered from a number of Indus sites. Not only are the terracotta figurines of those animals made but those are also depicted on the seals. (**Fig. 6.17**) As mentioned in Chapter 3, sometimes the elephants are depicted with a cloth on their back, indicating that those animals were tamed. There is also a clay model of an elephant head with painted designs on its forehead. Furthermore, a copper bronze figurine of an elephant on a pedestal has been reported from Daimabad, a 'late-Indus' site in Maharashtra. Most probably, those were employed as work animals. Elephant ivory seems to be used by the Indus people. At most of the sites, the presence of ivory pieces have indicated the existence of elephant.

Fig. 6.17 Elephant on a seal from Lothal (After S. R. Rao 1985)

Objects made of ivory, such as combs, mirror-handles, hairpins, rods and so on have been recovered from several sites. It is quite likely that Indus people were using hairpins made of ivory, though hairpins made of other materials are also known. Such pins have been recovered from a number of Indus sites. Mohenjodaro alone has yielded 12 such pins. Even the hooks to fasten boxes were made of ivory (Mackay 1937-38). In addition, a few examples of ivory scales have been reported, one of that from Lothal is 15 mm broad, 6 mm thick and 128 mm long, divided into 27 lines. The average distance between two lines is found to be 1.7 mm. (Rao 1985: 626). There are also some examples of the cylindrical ivory seals bearing inscriptions. Those seals were different from their steatite counterparts. There is evidence of ivory working at the Mohenjodaro and Lothal sites. Ivory might have been imported to those sites as raw material from a long distance, not necessarily from places where it has been associated in the habitation deposits, for manufacturing decorative objects and ornaments. The same can be said about the rhinoceros, whose bones are sparse in the faunal assemblages. Probably, the bones were brought to the sites for making bone tools and other objects (Thomas 2002: 414).

A number of carnivore species also made figured in the Indus assemblages. Those included the jungle cat, the desert cat, palm civet, the toddy cat, panther, wolf, jackal, Indian wild dog, fox, and hyaena and so on. In most of the cases, the charring and cut marks on the bones of those animals are not available and, therefore, it is not possible to comment on whether those species were consumed. In addition, a number of Indus seals depict tiger. Some of the tigers are shown as the horned beasts. Seals showing combat between humans and tiger are also found. Other important wild mammals reported from Indus sites include hedgehog, rhesus monkey, sloth bear and shrew, and so on. The remains of common rodents (common house rat, bandicoot rat and field rat) have also been reported from Indus sites. Of all the mammals that have become parasites, none are greater pests and more destructive than the rats and mice.

Signifecantly, the number of wild mammals actually represented in the different faunal assemblages differed appreciably from the total number of those that the Indus people used. While over 40 different wild mammalian species have been identified from Indus sites, only few mammals were found regularly in large concentrations within a single site, and fewer still occurred regularly from site to site. In addition, many species found at a site, by no means represented the numbers or types of wild mammals being used at that site. Therefore,

presence or addition of some species in some of the sites cannot be taken seriously, as the presence of those species in the assemblage might be a chance inclusion. For example, the inclusion of species, such as wolf, mouse deer, rhesus monkey and hedgehog, among others in the habitation deposits at Kanmer seems to be an accidental or chance inclusion. Furthermore, the range of sites excavated, methods of excavation, collection of faunal material and the process of analysis and identification may have significant impact on the status of emerging variability.

Varieties of birds were also exploited by the Indus people, but in comparison with the mammalian bones, those remain under-represented in the Indus faunal assemblages. There may by several reasons for that under-representation. First, the economic value of birds is negligible in comparison with that of the larger mammals. Secondly, bird bones are more susceptible to a number of taphonomic agents both before and after their deposition. Carnivores (dogs and cats) and omnivores (pigs) are potential consumers of the small and soft bones. Finally, the lack of water sieving or dry screening during the excavation may result in the under-representation of bones of birds.

The contribution of domestic fowl to the Indus subsistence economy has already been discussed. One of the other important birds exploited by the Indus people was the peafowl. The bones of this bird have been reported from a few Indus sites. Peafowl was a popular theme of the Indus pottery. Those birds have been native to the subcontinent and those generally live near the water sources. While no trace of human intervention has so far been detected on the skeletal parts of the peafowl, the possibility of this bird forming a part of the food economy cannot be ruled out. In addition, the peafowl has magnificent feathers, and even today, its feathers have been widely used in the cultural and spiritual contexts. Hence, the exploitation of its feathers can be a reason for its killing. Furthermore, peafowl is an omnivorous bird, which scratches in the cultivated fields and open land for its food: seeds, insects, and small lizards. Hence, it might even have been pursued as pests. According to Mcintosh, the *haia* bird, mentioned in a Mesopotamian text, might have been a peacock. If it were so, peacock must have been one of the live animals that the Indus traders took to Sumer as the diplomatic gift.

The cranes, partridges, pond herons and goose were the other birds that the Indus people exploited. The only reported data for those birds come from the Kanmer site. The crane was represented only by one complete first phalanx, devoid of any mark. The pond heron and the

goose were identified from a few skeletal fragments, and the cut marks on their bones indicated that those birds were consumed as food. The partridge was known from the meat-bearing body parts, such as the coracoid and humerus from the shoulder girdle, as well as the femur from the leg. The small number of distal wing bones of that bird in the assemblage may be related to the poor economic value and the removal of that part during processing. Partridge has traditionally been a preferred game bird, sought after for its taste. It is likely that the partridges were hunted during the Indus times. While the skeletal evidence for cranes come in the form of a single bone from the Kanmer site, representations of this bird found on the painted pottery from a number of sites in the Bannu basin, dated to the fourth millennium BCE, have been tentatively identified as cranes. There is a long history of capturing those birds in this part of Pakistan since the ancient times (Khan 1991: 97-99).

A number of bird figurines have also been reported from the Indus sites, and it seems that those were quite popular during the Indus times. However, most of these are difficult to identify.

The reptilian fauna, like birds, are also under-represented in the Indus faunal assemblages. Only four species of reptiles have been identified from the Indus sites. Those include monitor lizard (*Varanus bengalensis*), Indian mud turtle (*Lissemys punctata*), Gangetic soft-shell turtle (*Kachuga tecta*), and Chitra turtle (*Chitra indica*). The skeletal elements of turtles indicate that those were consumed, besides the bones of snakes and crocodiles have been reported from Indus sites. Snakes, in particular the cobra (one of the deadliest snakes), have been depicted on Indus seals and sealings (Possehl 1999: 222-223). Furthermore, there are a number of representations of the *gharial* (one of the crocodiles) in the art of ‘mature-Indus’ phase.

Exploitation of Aquatic Resources

Besides the terrestrial resources, aquatic resources also played an important role in the Indus subsistence economy. The Indus people intensively utilised aquatic resources like fish, molluscs and crustaceans. (**Fig. 6.18**) A combination of those aquatic adaptations and the use of a range of terrestrial plants and animals show that the Indus people had a diversified and stable resource economy. Such an economy certainly contributed significantly to the development of that civilisation. It also appears that the Indus people used aquatic resources whenever and wherever those made economic sense to them. Following is a brief discussion on fishing and shell technology of the Indus period.

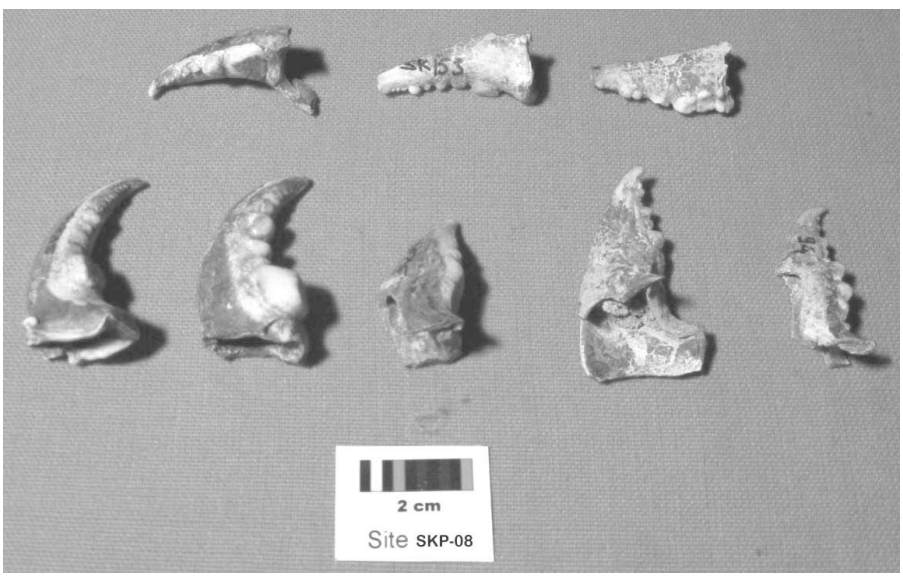

Fig. 6.18 Crab remains from Shikarpur, Gujarat

Fish and fishing

Fish has been one of the important and valuable sources of food, since ancient times. As a staple food item, fish probably found favour with the man at a very early stage of history. Prehistoric men the world over seem to have collected sufficient knowledge about fish behaviour, and they made use of that knowledge in catching fish. According to one theory, fishing was known to the man before he started hunting terrestrial animals, for that required much simpler tools. The fishing has been given as one of the reasons that prompted migration of

humans from the African continent.

Fish catching or gathering is also supposed to be one of the oldest industries in the world. During the nascent stages, handpicking might have been employed to gather fish and other aquatic resources along the shores of lakes, rivers and seas. The spear might have replaced the primitive method of handpicking. Thus, the spear might be the earliest weapon that humans used for fishing. Nevertheless, handpicking method is still in use in many parts of the world, as in the modern northwestern European countries (Ayyappan et al. 2007: 259). Gradually, humans developed various tools and techniques for fishing.

Although the study of fish remains from the archaeological sites is now an integral part of the environmental archaeology, the same is not true for India. Little work on fish remains was carried out in this region until recent years, and the information about the type and species of fish (remains) is scarce. General terms, like fish, catfish, sawfish, carps, and so on commonly appear in the faunal reports. This is mainly due to the lack of expertise and the nonavailability of modern references of fish. In addition, the recovery methods employed in the collection of animal bones often resulted in a low representation of fish bones in the sites. Consequently, very little is known about the role that fish played in different cultural periods. However, fish were regularly caught by the hunter-gatherer communities in the Indian subcontinent, as is vividly shown in the rock art at Bhimbetka and other central Indian sites. Some of the early paintings in those rock shelters have been placed in the Mesolithic Age. In addition, fish bones were among the faunal remains at several mesolithic sites. Furthermore, otoliths (ear-stone) of a fish, tentatively identified as belonging to the family Channidae and the genus *Channa* or *Ophicephalus*, have been recovered from a number of mesolithic sites in north Gujarat (Ajithprasad 2004: 130). In all probability, fish were an important part of the mesolithic diet. However, from the meagre remains recovered, it is difficult to evaluate how much fish contributed to the diet of the mesolithic people. While direct evidence of the fishing technology during that period is not known, ethnographic attempts have been made to reconstruct that. Same situation may be seen in the succeeding neolithic and chalcolithic periods, where almost nothing can be reconstructed because of the scanty fish remains in the faunal assemblages of those sites. The means of catching fish are also difficult to reconstruct in the absence of reliable evidence.

The only cultural period where definitive evidence about the fishing industry are available is the Indus civilisation. William R. Belcher's study of fish bones from Indus sites—Balakot, Allahdino, Harappa and

Nausharo—for his doctoral dissertation revealed extensive use of riverine and marine fish in the Indus subsistence economy. That study is significant,for that it provides a body of information, previously unknown, pertaining to the Indus fishing industry. According to the study, that industry was not only well organised, but that also provided food for a section of the population in the urban and rural settlements. That was especially true of some of the fish that exceeded two metres in length. In some cases, as at the Balakot site, fish provided around half of the faunal diet. A similar range of fish species, including various types of carps and catfishes, were used at the other sites, such as Allahadino and Harappa,.

The evidence of trade of dried or salted fishes also comes from the tiny site of Prahag, located west of Balakot along the Makran coast. That site revealed the evidence of fish processing on a large scale. Fish species, like skate, jack, grunt, marine catfish, drum and small shark appear to have been caught locally. Those fish were then cut open and their heads and tails removed, and then those might have been preserved by salting and drying for trade. The presence of a large number of bones of shark, marine catfish, drum, sea brim and jack at the site of Miri Qalat in Baluchistan, located 120 km from the coast, also furnish evidence of a flourishing trade of preserved marine fish (Mcintosh 2008: 136-137).

The inferences about the technology used for fishing during the Indus period are greatly strengthened by the presence of other material remains associated with fishing. Those include copper or bronze fishhooks, terracotta net weights and ceramic motifs (**Fig. 6.19**) Of those, copper-bronze fishhooks of varying sizes have been recovered from a number of Indus sites, such as Harappa, Chanhudaro, Mohenjodaro, Padri and Bet Dwarka, and others. Sarkar classifies the fishhooks from the Indus sites into two main types: (1) Barbed and (2) without barb. Those hooks can be further classified as hooks having a straight shank, without forming any curve or eye; having a straight shank, but turned outwards; and having a straight shank, but curved to form an eye (Shinde and Thomas 1992: 146). According to Belcher (2003: 107), the variety of hook sizes suggests that a number of fish species were caught by angling. It is proposed that the barbed fishhooks were most probably used for catching large marine fishes and unbarbed ones for catching small riverine fishes (Shinde and Thomas 1993: 145). Additionally, the presence of copper fishhook in the context of late Harappan period suggests that the fishing activities continued even after the prosperous phase of the Indus period. It is argued that the fishhooks recovered from the Indus sites were quite similar to the modern ones and, therefore, are suggestive of a

continuity of this cultural trait (Sarkar 1953: 133-139).

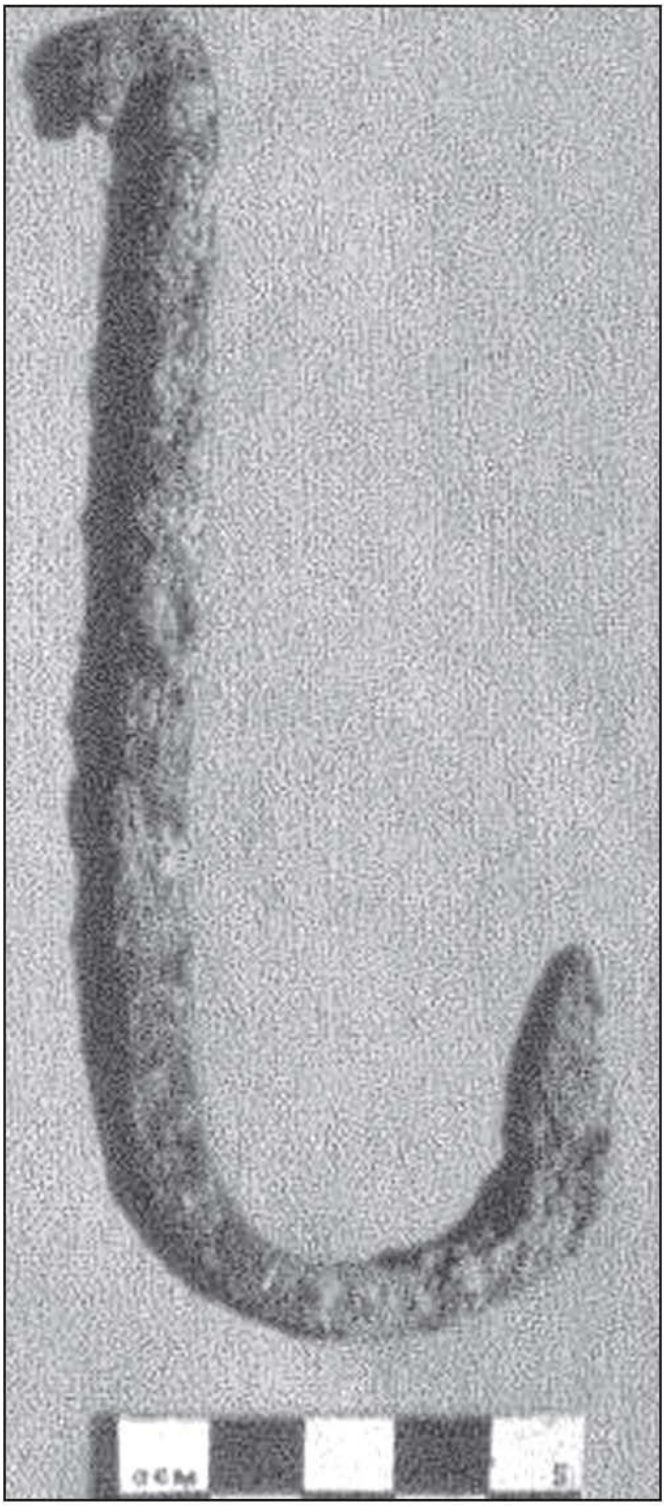

Fig. 6.19 Fish hook from Padri, Gujarat (Courtesy: V. S. Shinde)

While the presence of fishhooks in a number of Indus sites shows that angling was a common practice, larger catch might have required various types and sizes of nets. However, nets are rarely available in archaeological sites, as those were generally made of the perishable material. Nevertheless, Belcher states that different sets of data can be used to infer the presence of netting in fishing technology in the archaeological contexts. He argued that the material remains of the Indus sites are the evidence of existence of the net making activities at several Indus sites (Belcher 1994: 129-142). Fish imagery was very much a part of the Indus culture. A number of evidence showing fish and fishing activities have been recovered from various Indus sites, such as the ceramic motifs that offer a unique look into the Indus fishing industry, the types of nets used and the manner of using those. The most detailed representations come from Harappa, where one motif depicts one person holding a complex net gear or a throw net. Another motif shows a number of fish along a seine net (Belcher 1994: 139). Additionally, some scholars have defined the large brick-lined enclosure at Lothal, popularly known as a dockyard, as a fishing tank, which may be an interesting suggestion for the use of that facility. The evidence cited above clearly shows that Indus people possessed an extraordinary fishing technology.

Exploitation of molluscs

Molluscan shells are one of the earliest natural resources that the humans exploited. Those shells were not only used for dietary purposes, but, being durable and ornamental, were also used for making different objects. The exploitation of molluscs can be traced back to the middle and upper Palaeolithic cultures of the late Pleistocene period. In India, the earliest evidence of utilisation of shells came from the upper Palaeolithic site of Patne in Maharashtra. That site revealed a shell of estuarine *Oliva* sp. with a deliberate perforation on it. That shell has been interpreted to be a bead, manufactured by rotating a stone drill or point at the apex to make a perforation. The occurrence of different types of shells has also been mentioned in a number of mesolithic sites, as at Lekhalia, Tarsang, Kanewal and Langhnaj and others, but very little is known about the role and significance of those. However, there is evidence for shells being used for manufacturing various ornaments and other artefacts during the subsequent cultural periods. Kenoyer's analysis of shell artefacts from the Mehrgarh site revealed a gradual development of shell working from the neolithic period onwards (seventh to sixth millennium BCE onwards) (Kenoyer 1995: 566-581). However, only little comparative and stratified data is available from other neolithic sites.

The shell working industry emerged as one of the most prominent industries during the Indus period. A number of different species of marine and freshwater molluscan shells have been reported from most of the major Indus sites. **(Figs. 6.20 to 6.24)** Of those, the shells of only a few species, such as *Turbinella pyrum*, *Chicoreus ramosus*, *Fasciolaria trapezium*, and *Pugilina buchephala,* and so on, were actually used for manufacturing shell objects. The preference for those gastropods was the suitability of their unique structure for manufacturing specific types of objects, and to procure that raw material, different areas were explored (Kenoyer 1984: 49-63). Besides, those gastropods were amply available in colonies, which guaranteed continuous supply (Deshpande-Mukherjee 1998: 63-80). The distribution of shell debris in different Indus sites shows that different manufacturing jobs were oftenly undertaken at different locations. For example, separate areas were specified for cleaning of shells, production of bangles, inlaying and production of ladles at Nageshwar site. Likewise, we find similar segregation in the shell activity at Gola Dhoro site, where three large heaps of the unworked shells, discarded shells and roughed-out bangles were located in different places. In addition, the large quantities of unworked shells, stored ready for use, and a huge amount of waste material clearly indicate the large-scale production of shell artefacts at the Gola Dhoro and Balakot sites. **(Figs. 6.25 and 6.26)**

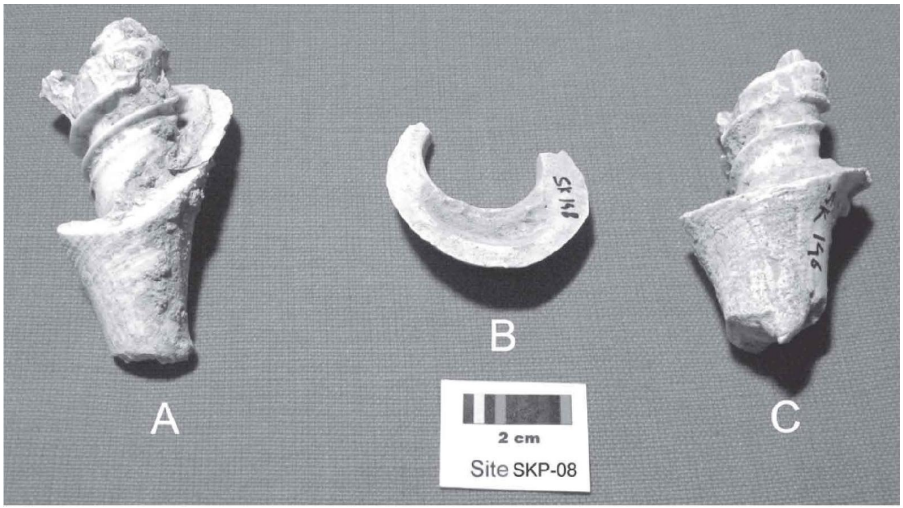

Fig. 6.20 Shell waste of T. pyrum *from Shikarpur, Gujarat*

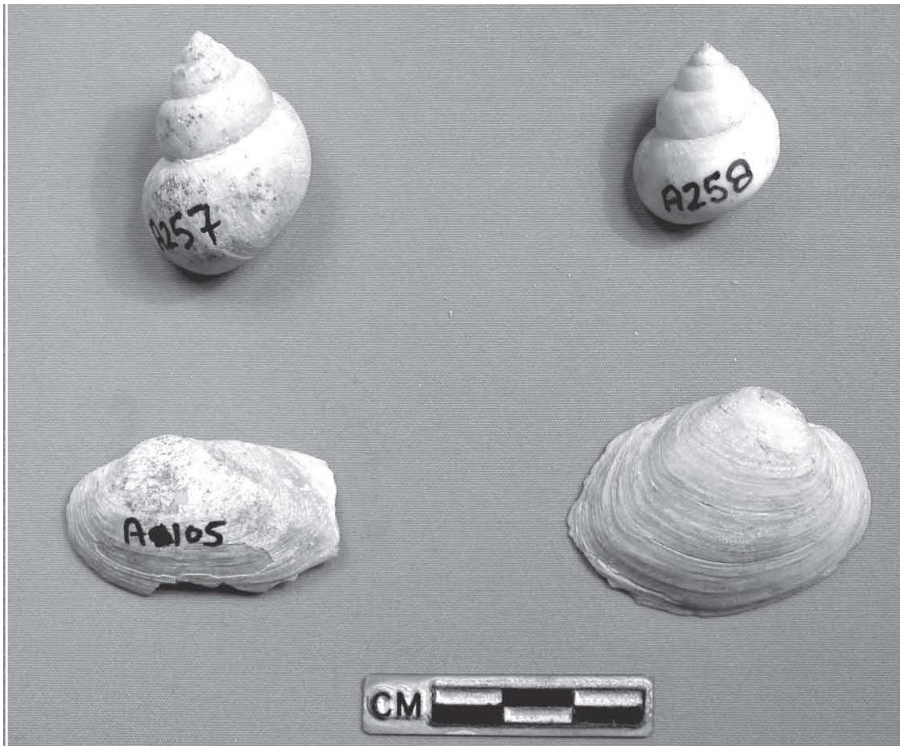

Fig. 6.21 Freshwater molluscan shells from Alamgirpur, Uttar Pradesh

Fig.

6.22 Molluscan shells from Mitathal, Haryana

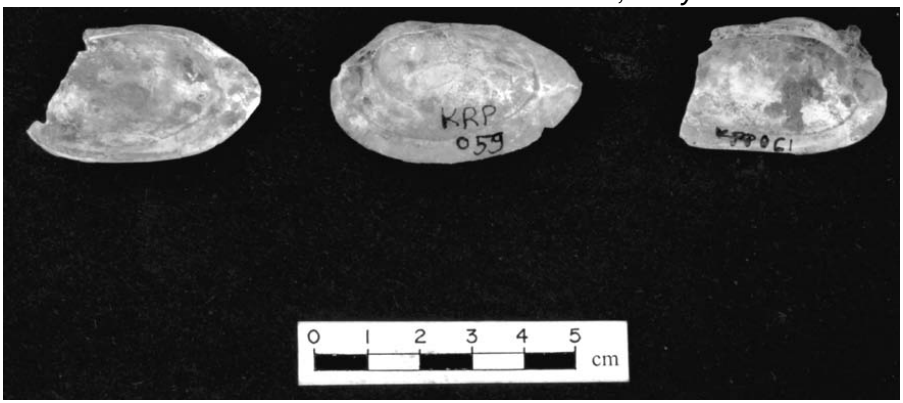

Fig. 6.23 Freshwater mussels from Karanpura, Rajasthan

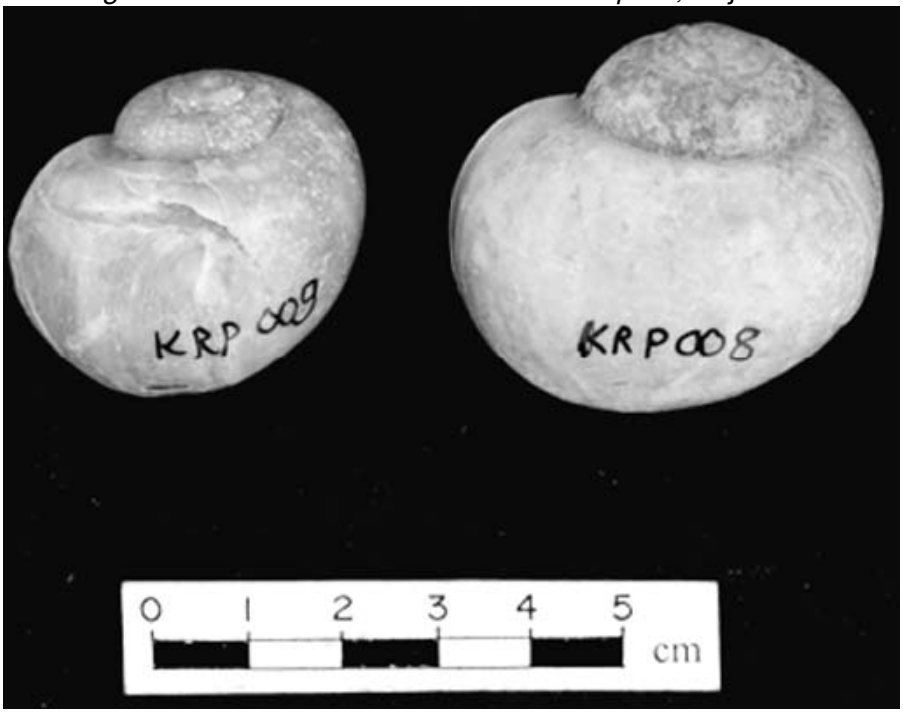

Fig. 6.24 Pila globosa from Karanpura, Rajasthan

Fig. 6.25 Heap of unworked shells from Nagwada, Gujarat (Courtesy: Prof. V. H. Sonawane)

Fig. 6.26 Heap of unworked shells from Bagasara, Gujarat (Courtesy: Prof. V. H. Sonawane)

Although there are a number of miscellaneous products, such as ladles, spoons, inlay pieces and occasional decorative items that were made from shells during the Indus period, the shell bangles and beads recovered from almost all the sites attract particular interest. Successful attempts have been made to reconstruct the manufacturing technologies of those objects. Detailed studies conducted by various scholars have shown that manufacturing technology was uniform and

standardised. Most of the shell bangles were produced from *T. pyrum* (also known as conch shell). The diagonal technique of sawing the shell to produce the bangle circlets was the most common (Deshpande-Mukherjee 1998: 63-80; Kenoyer 1984: 49-63). That method involved the preparation of shell for sawing by hollowing out the interior. After removing the interior, the irregular portion of the shell was removed. The remaining hollow spire was then sawn into rough circlets of desired width. Finally, the interior of circlet was ground either by using cylindrical sandstone or some other abrasive tool. The exterior was also ground on a flat sandstone slab. Most of the finished bangles were perhaps incised with a motif of a chevron 'V'. The incised designs on the bangles could have been made either using a chert blade or a more specialised copper or bronze file (Kenoyer 1984: 54). While *shankh* was the most common shell for making bangles, other shells, such as *C. ramosus*, *P. bucephala*, *Tivela damaoides* and others were also used. However, the difference in shell morphology affected the form of finished bangle. For example, the bangle made from *C. ramosus* was generally larger in diameter to the one made from conch shells (Bhan et al. 2002: 224). **(Fig. 6.27) (Fig. 6.28)**

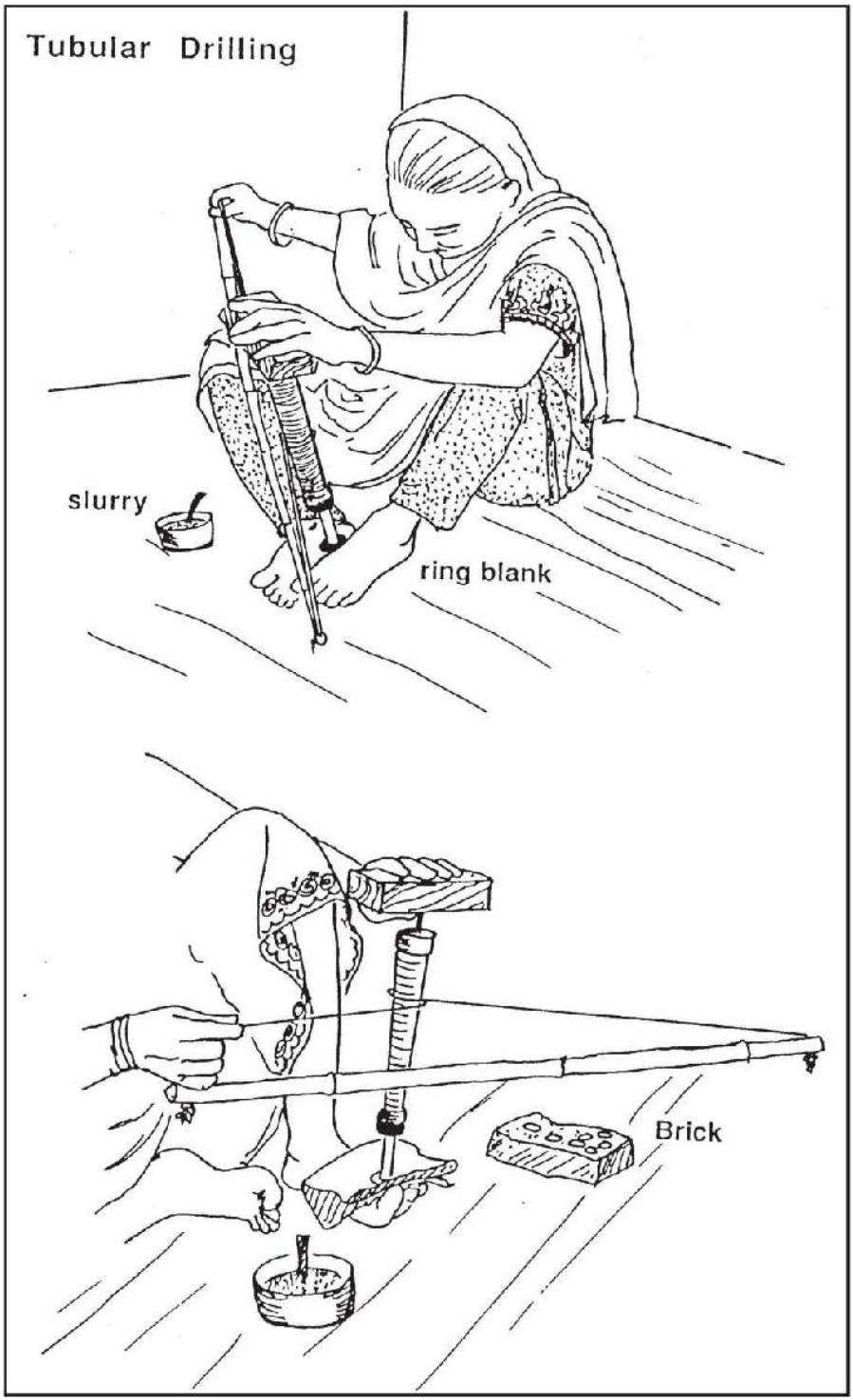

Fig. 6.27 Shell technology (Courtesy: Prof. K.K. Bhan)

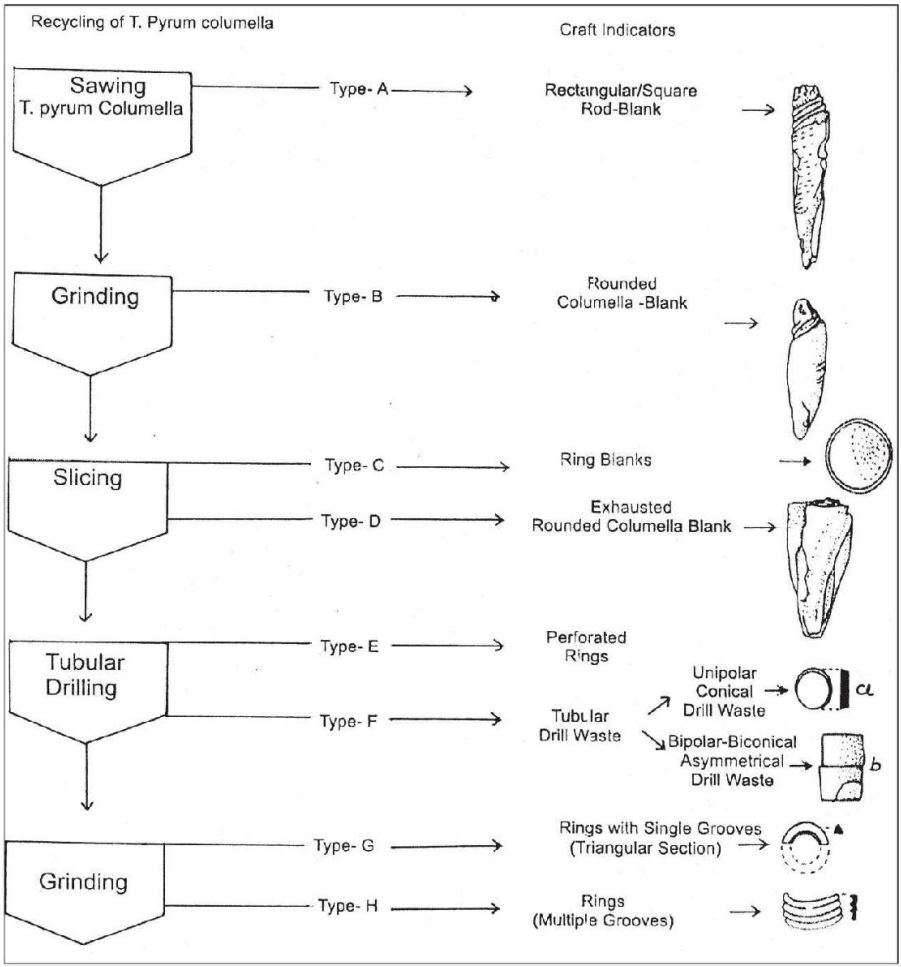

Fig. 6.28 Shell technology (Courtesy: Prof. K.K. Bhan)

Shell beads were probably made from the fragments of outer shell and the columella of larger gastropods, such as *T. pyrum*. For making shell disc beads, shells were first broken into smaller chips, which were then perforated. Finally, the rough beads were ground on a flat piece of sandstone to make those perfectly circular. Smaller perforations were probably made by the tiny chert drills using a simple bow drill (Kenoyer 1984: 55). Francis has discussed five non-drilling techniques: 'gouging', 'scratching', 'sawing', 'grinding' and 'hammering'. In 'gouging', a pointed tool is placed on the shell and pressed with a twist. The 'scratching' involves scratching many small furrows, resulting into an opening in the shell. In 'sawing', a continual action of a blade forms an elliptical hole. The 'grinding' involves perforation by rubbing of shell against a hard surface. In 'hammering' repeated blows are delivered until a perforation is obtained. Besides the large gastropods, small shells like *Agaronia nebulosa*, *Natica* sp., *Cypraea* sp., *Erosaria*

lamarcki, *Nerita* sp., *Dentalium* sp. were also made into beads at the Kuntasi, Padri and Shikarpur sites by employing simple techniques, like gouging, boring and rubbing to perforate the shells (Deshpande-Mukherjee 1998: 71).

A specific technique of chipping and cutting shell was known from the different Indus shell workshops, wherein even the width of saw blades made of copper or bronze was found to be identical. The extremely thin (between 0.4 and 0.6 mm) saw used for cutting shell had a long convex cutting edge (Kenoyer 1986: 18-23). The present-day shell bangle industry in Bengal also uses a semi-circular iron saw with a bidenticulate edge (Deshpande-Mukherjee 1998: 72). The more impressive fact is that the Indus bronze saw was able to cut shell as efficiently as modern steel saws. One of the characteristic features of the Indus shell technology was that the shells were used in such a way that, besides using the main shell whorl, the resulting shell debitage was used for making different objects. For instance, a study of the waste fragments of shells at the site of Nagwada reveals that those were recycled to produce a variety of tiny, flat and geometric forms, which may have been used as inlay pieces (Hegde et al. 1988: 60).

The Indus artisans were extremely skilled at shell working, as can be seen in a wider range of objects that were made of shell. **(Figs. 6.29 to 6.31)** The presence of shell artefacts, like cone, gaming pieces, wavy rings, lids, spheres, pendants, buttons, toy cart frames and animal figurines and others at different Indus sites show the real skill of the Indus shell workers. Those objects were generally made of terracotta or other material, and their manufacture from shells was one of the noteworthy features of Indus technology. Kenoyer has discussed the manufacturing process of some of those objects in detail (Kenoyer 1984: 57-60). In addition, conch shells were sometimes hollowed out in such a way that those could be used as a libation vessel. That must have been done with great difficulty. Other important shell artefacts that showed highly skilled artisanship were the shell compass, recovered at Lothal, a conch shell trumpet found at Harappa, a unique ‘late-Indus’ seal found at Bet Dwarka and a spherical shell object found at Nagwada. Objects like those have posed a difficulty for scholars to reconstruct their mode of manufacture.

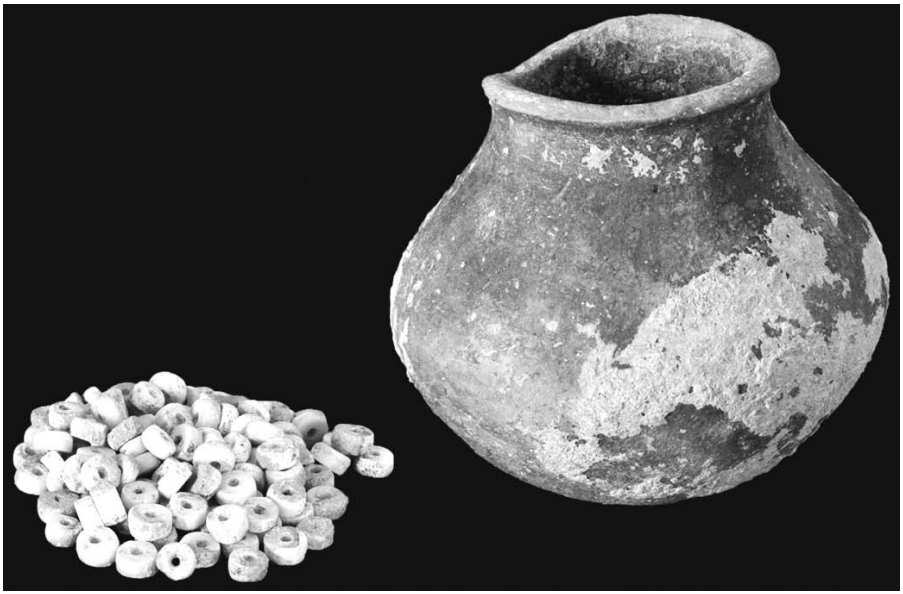

Fig. 6.29 Shell beads from Kanmer, Gujarat (Courtesy: Dr. J. S. Kharakwal)

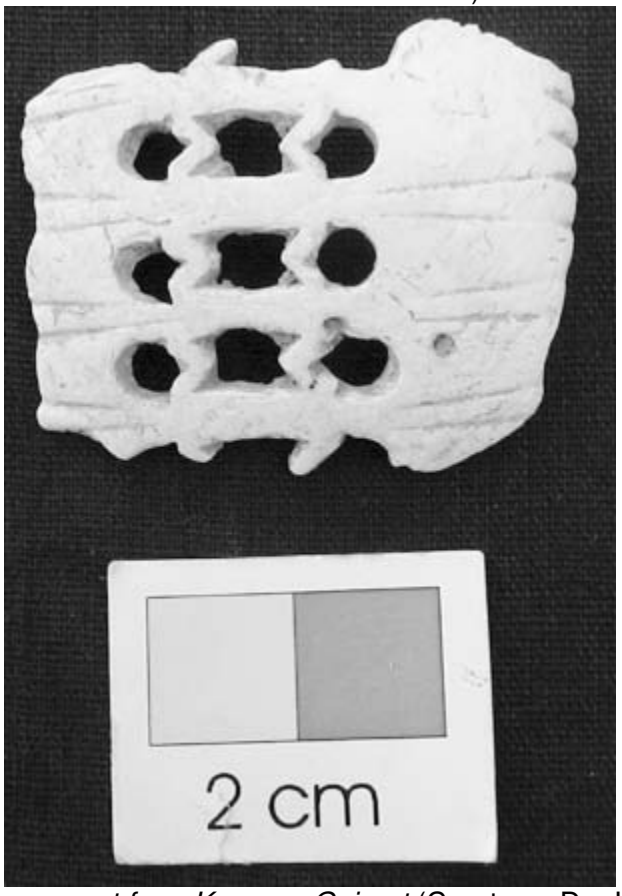

Fig. 6.30 Shell ormanent from Kanmer, Gujarat (Courtesy: Dr. J. S. Kharakwal)

Fig. 6.31 Shell disc from Kanmer, Gujarat (Courtesy: Dr. J. S. Kharakwal)

In a review of the shell industry of Gujarat, Bhan and Gowda identified three levels of distribution and production of shell artefacts in Gujarat:

1. Sites like Nageswar and Bagasara revealed a limited range of artefacts. Those places might have been geared for trade in raw and finished goods to the regional and extra-regional markets.
2. A large number of Indus sites in Gujarat, such as Surkotada, Rangpur, Lothal, Nagwada and Kuntasi, produced a wide variety

of shell objects. Those places appear to have been catering to the local and nearer markets.

3. The third level of production can be seen in the distant north Gujarat settlements, where small occurrence of shell working has been noticed. That could reflect the activity of travelling shell cutters or traders, who visited those sites for the production of shell items on the specific local demand (Bhan and Gowda 2003: 51-80).

In addition to using shells for making various utilitarian and ornamental objects, the shells were also used for dietary purposes during the Indus period, particularly in the coastal sites. A study of the shell fishing and shell crafts during the Indus period in Gujarat has shown that at the coastal Indus sites, like Kuntasi, Shikarpur, Nageshwar, Gola Dhoro and others, seasonal harvesting of edible shellfish was carried out (Deshpande-Mukherjee 1998: 76). According to her, there was a general preference for bivalves, although a few gastropods were also collected. Meat extraction from the shells was done by boiling, steaming and roasting. On the overall dietary contribution of shells Deshpande-Mukherjee states, ‘Considering the molluscan contribution in the overall diet, as compared with the major food types, shellfish has a fairly insignificant role to play. Nevertheless, molluscs being easily procurable had supplemented the diet of the coastal Indus people in Gujarat with added proteins and necessary minerals’ (Deshpande-Mukherjee 1998: 76).

Animals and Folklore

Some of the Indus potteries depict animals and birds in a story form, which shows that some of our folktales had their origin during the Indus period. For example, one of the small red ware recovered from the 'mature-Indus' levels depicts a deer and a crow, and a pitcher in between them (Rao 1985: 412). (**Figs. 6.32 and 6.33**) The deer's front right leg has been shown outstretched, as though it is about to move forward. However, the neck of deer is shown turned backwards, with eyes in wide with amazement. The crow's beak is depicted right above the pitcher. While the contents of pitcher are not easily made out, one can see some roundish objects and a couple of lines. All told, that depiction reminds us of the famous story of 'The Thirsty Crow'. According to the story, there was some water in a pitcher and a thirsty deer wanted to drink it. However, he could not drink it, as the level of water in the pitcher was too low. Disappointed, he was about to walk away, when he noticed a crow near the pitcher. The crow was also thirsty, but it was intelligent. He dropped some pebbles in the pitcher that raised the water level and the crow could quench its thirst.

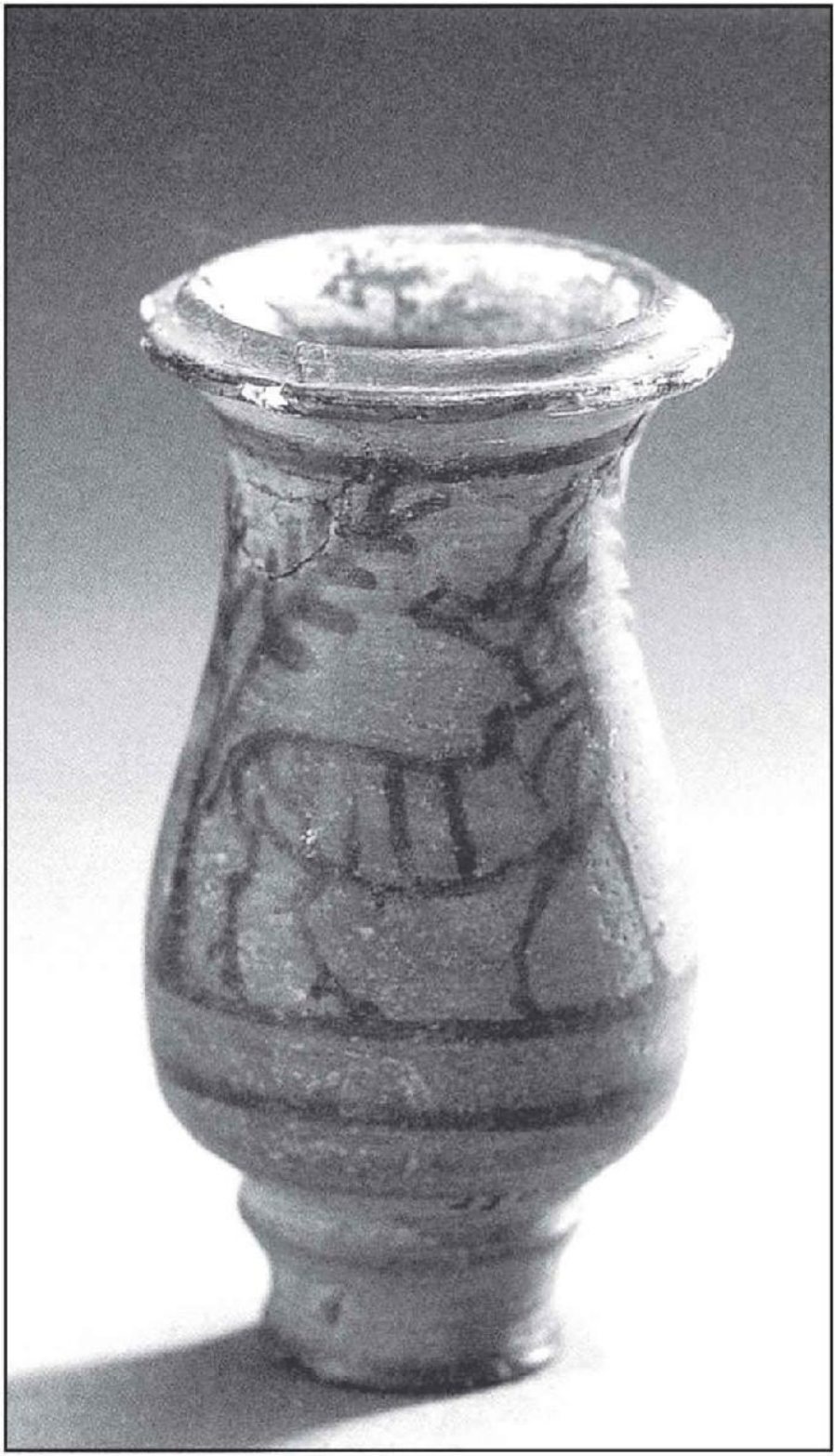

Fig. 6.32 Pot depicting story of crow and deer from Lothal (After Rao 1985)

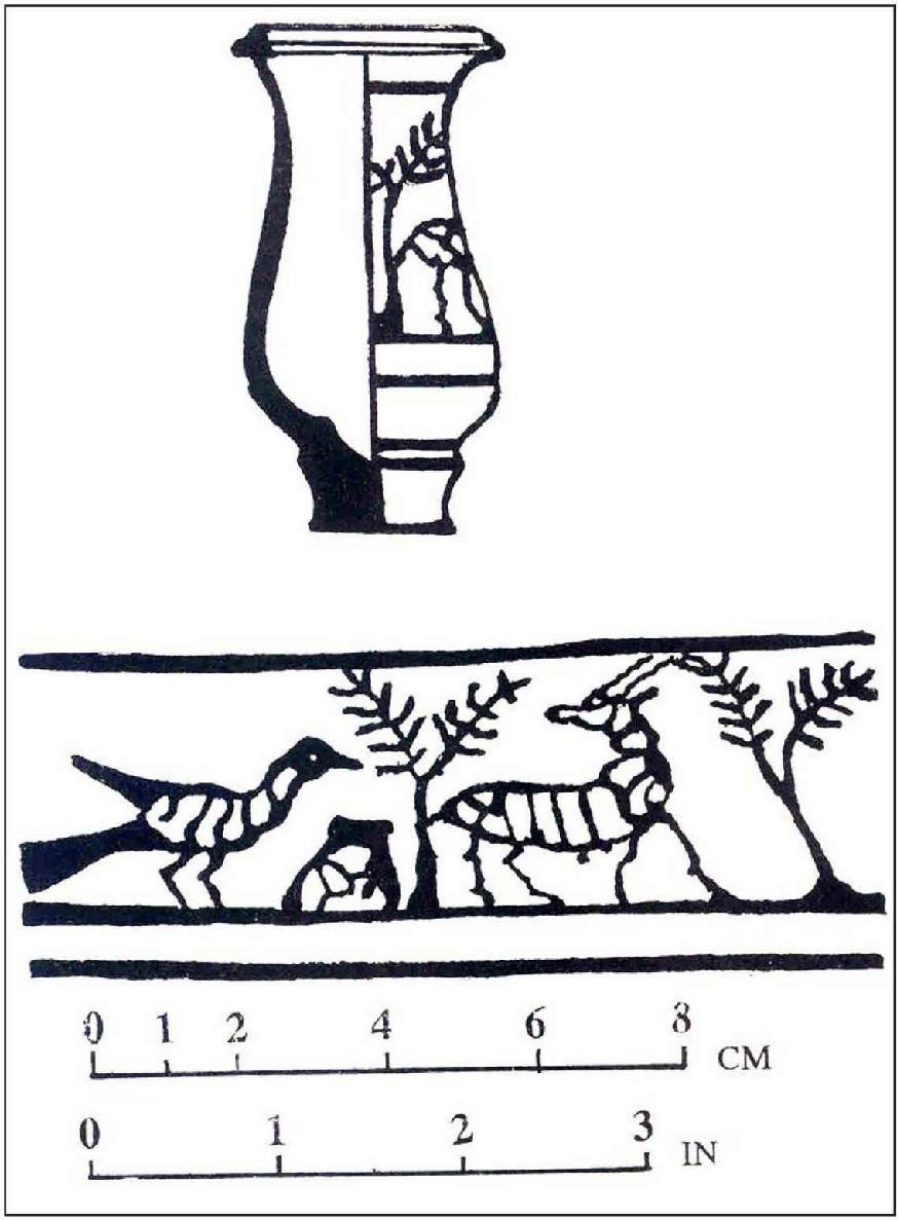

Fig. 6.33 Sketch of story of crow and deer from Lothal (After Rao 1985)

Another painted jar from Lothal seems to narrate the story of 'A Cunning Fox' (Rao 1985: 354). (**Fig. 6.34**) That jar depicts two birds, with partly open wings, perched on a tree. The birds are holding fish in their beaks. At the bottom left, an animal is portrayed in solid colours. Close by is a small hatched object. Altogether, the story tells that a fox

saw some birds sitting on a tree with some food in their mouth. The fox instigated the birds to sing a song, for these have beautiful voice. The birds felt jubilant at the praise and started singing. The moment the birds opened their mouth, the food dropped down and the cunning fox ran away with it.

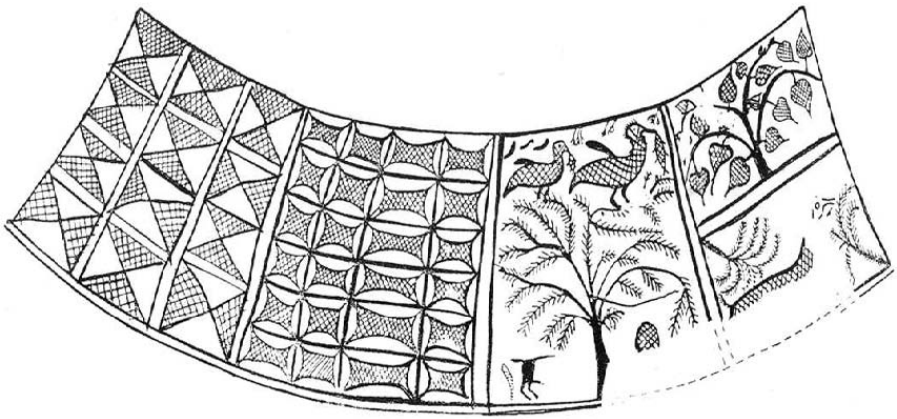

Fig. 6.34 Depiction of cunning fox story from Lothal (After Rao 1985)

Role of Other Specialist Groups in the Indus Subsistence Economy

While there is no doubt that agriculture played a significant role in the Indus subsistence activities, the animal products, such as meat, milk and milk products, should also be remained an important part. As already noted, the faunal remains from the Indus sites revealed a wider spectrum of animal species during that period than before, which may reveal the efforts of Indus people to lessen risks associated with the limitation of agricultural and animals resources. Consequently, the Indus subsistence system may at best be conceived as an integrated and cohesive system comprising both, the plants and animals. It brings forth the presence of specialist groups who might have supplied such resources to the Indus population. Research has been done to identify those ‘invisible’ specialist groups during the Indus civilisation.

Cattle were an important animal source for the Indus people but the pastoral groups tending small cattle made a significant contribution to the Indus subsistence economy. However, pastoralism has been a relatively neglected topic among the archaeologists, as the data for the pastoralists is difficult to recover. The tendency of pastoralists to remain mobile, living in the temporary shelters for short periods and acquiring minimum material cultural items makes the archaeological study of pastoralism problematic. Nevertheless, considerable efforts have been made in the recent years to study the archaeological sites with the pastoral component.

Efforts have been made to study pastoral nomadism in the Indus civilisation. The extraordinary ‘empty spaces’ between the Indus clusters of settlements, and the isolated contexts for a number of individual sites have been identified. Some of those ‘empty’ and ‘isolated’ spaces are quite small. Based on that peculiarity, Possehl argues that those ‘empty spaces’ might have been occupied by the mobile pastoralists as groups, bridging the gaps between different settlements. He regarded pastoral nomads as the carriers of information, transporters of goods and the medium through which the Indus civilisation achieved its remarkable degree of integration during the mature-Indus phase (Possehl 1979: 537-551). However, observing the apparent danger in hypothesising the existence of pastoralism exclusively based on settlement pattern study, he restricted himself by referring to it as a ‘workable hypothesis’ only. ‘This model is offered not as a final synthesis of the material, but as a hypothesis against which

future field research can be tested' (Possehl 1979: 539).

Investigations carried out at the 'late-Indus' site at Oriyo Timbo is one of the classic studies of pastoralism in India. The excavation at thst site revealed the evidence of such architectural features that might have remained temporarily in use. Among those were the two different types of fragile hearths and several hoof prints of cattle. The absence of architectural features on the surface of that site may suggest that the human settlement at Oriyo Timbo did not exist. Rissman, who studied the age structure of faunal remains unearthed from the site for his doctoral dissertation, postulates that the production of meat for consumption was not a significant aspect of the Oriyo pastoral economy, but the secondary products, like milk, ghee, wool and hair were. Furthermore, the study of annular rings of cattle teeth has shown that the site was occupied in the months of March through July (the season of late winter, entire summer and early monsoons). Moreover, Reddy's study of plant usage and subsistence at Oriyo Timbo also revealed that the subsistence system at the site was primarily geared towards animal husbandry and not to the crop cultivation (Reddy 1994: 162187). Instead, the occupants of Oriyo were every season bringing millets on occupation, or were either trading or exchanging meat and other animal products for grains from the neighbouring agriculturalists. To sum up, when all that evidence are considered together, it appears that the inhabitants of Oriyo were the part of a larger and more complex subsistence system, where the nomadic, semi-nomadic or semi-sedentary pastoralists played an important part.

Based on the study of a settlement grid of post-urban Indus phase in Gujarat coupled with the sizes of the sites, Varma suggested a shift in the subsistence strategies from farming to herding (Varma 1991: 279-300) Recently, Swayam tried to understand the nature of pastoralism during the 'mature-Indus' phase in Gujarat (Swayam 2006: 50-80). He recognised the importance of the unearthed bio-archaeological materials (faunal and floral remains) as a useful database for inferring the pastoral production system at a particular site together, taking into consideration the ethno-archaeological implications, to understand pastoralism. His study revealed the existence of pastoralist way of life during the 'mature-Indus' phase in Gujarat. Of late, faunal studies conducted at the Indus sites of Kanmer and Bagasra have highlighted the role of pastoralists in the Indus economy.

Research has also been done to find out the role of hunter-gatherer in the Indus civilisation. The theory of an interdependent economic relationship between the prehistoric hunter-gatherers and urban

agriculturalists during the Indus period in Gujarat was initially developed, elaborated and further expanded by Possehl. He established the relationship between the people living at Lothal and Langhnaj. (Possehl 2002: 6276). That was later corroborated by the anthropological evidence.

The site of Langhnaj revealed the archaeological evidence of a 98 percent pure copper knife, Black and Red Ware typologically similar to those recovered from Lothal, and Indus type disk beads. The presence of those artefacts at Langhnaj, according to Possehl, strongly suggests interactive exchange between the occupants of that site with their counterparts at Lothal. He supported this with the idea of Lothal as a 'gateway settlement', through which the raw materials obtained from the hunter-gatherers were transported to the other towns and cities of the Indus civilisation (Possehl 1976: 118131). The study of the human skeletal remains from Lothal by Kennedy also suggested that a number of physical traits present in the human skeletons from Lothal had closest biological affinities with some of the hunter-gatherer communities, whose descendants survive as indigenes in modern India (Possehl and Kennedy 1979: 592593). That data indicated a likelihood of regular gene flow between the Indus people and the hunter-gatherer population in the prehistoric Gujarat. Kennedy et al. (1984: 105-118) further substantiated the probability of gene flow between the two groups by conducting complex statistical analysis on skull measurements of the Lothal and Langhnaj specimens (Kennedy et al. 1984: 105-118). Lukacs's comparative analysis of the dental diseases that had been prevalent among several 'mesolithic' groups of the Indian subcontinent indicated a new dimension to the genetic and economic links between the inhabitants of Lothal and the nomadic foragers of Langhnaj. The rate of dental caries for Langhnaj, according to him is 8.0 percent (a value significantly different from the 'mesolithic' range, but near to the mid-point of the range of values typically associated with agricultural groups). He interpreted that the dental anomaly was because of the consumption of refined agricultural food items that the people at Langhnaj might have obtained through trade from their contacts with the inhabitants of Lothal (Lukacs 2002: 41-61).

To summarise, the hypothesis of interaction between the occupants of Lothal and Langhnaj has gradually evolved over the last thirty years. Both, the archaeological and bio-anthropological data have provided valuable confirmatory evidence on the role of trade for subsistence of the pre- historical hunter-gatherers of South Asia and their interaction with the settled agricultural communities. In addition to the evidence related to Lothal-Langhnaj interactions, we have evidence of an interdigitation of habitation of hunter-gatherers and Indus people at the

Kanewal site, located in Kheda district of Gujarat. That site revealed an occupational level with a transitory settlement of the hunter-gatherer people, following one of the post-urban Indus phases in Gujarat. That evidence is also important, as it provides stratigraphic evidence, placing hunter-gatherer people in Gujarat within the same general period (Possehl 2002: 70).

From the perusal of above account, the faunal picture emerging from the Indus sites indicates the presence of several groups, specialising in different occupations, such as hunting, gathering, cattle pastoralism, sheep-goat pastoralism and fishing. The integration of those might have been responsible for the subsistence economy of Indus civilisation. However, the way those specialist groups interacted with the Indus population or the means by which such resources were integrated into the Indus economy is still not well understood. Meadow asks, 'Did an occupational specialization of hunter and fisherman come to be established to supply agricultural and urban communities or did previously segregated specialist occupational groups, so far invisible to archaeology, come to be included in Indus communities or integrated into the Indus system' (Meadow 1989c: 68) We also need to understand the social considerations, which are arguably most likely to have played an active role in the animal-based subsistence economy at the Indus sites. While it is maintained that the initial impetus for hunting, animal husbandry, fishing and agriculture and others was for reasons relating directly to subsistence needs, social factors must also be forced into any coherent model, as most human actions take place in a social context. In practical terms, it is not conceivable for a single group to do everything essential for its long-term survival. 'Human groups diversify in terms of specialisation on one or the other natural resource or a limited combination of them, be it individual animal groups like cattle, donkey, camel, deer, snake, fish or various plants, or even inorganic substances like stones, thus forming a system network in which specialised products move between different groups' According to Chattopadhyaya (2002: 409). Therefore, if we want to understand the variations in the Indus organisation, we must expand our understanding of various relationships between exchange and pattern of technology, settlement and social organisation, and the need to develop precise tools to examine the role of food exchange during the Indus period.

Animal-Based Subsistence During the Late Indus Period

While large numbers of ‘late-Indus’ sites or levels have been excavated, information of the ‘late-Indus’ fauna comes mostly from Gujarat. Therefore, this section will focus only on the data coming from Gujarat. As was the case during the ‘mature-Indus’ period, the animal-based subsistence economy during the ‘late-Indus’ period also relied heavily on cattle. However, the faunal data analysed from a number of Indus sites in Gujarat, like Rangpur, Surkotada, Nageswar, Kuntasi, Shikarpur Bagasra, Jaidak, Kanmer and others show the exploitation of wild fauna at its maximum towards the close of that period.

Different reasons can be given for the greater reliance on the wild animals during the later phases of Indus occupation at those sites. As discussed above, the ‘late-Indus’ period marks the decline of Indus culture, which could be noticed in their economy, agriculture, industrial and commercial activities and social aspects. That period is also viewed as a time of fluctuating climatic and ecological conditions, which are held responsible for the periods of food stress (Minnis 1985: 16-42). Although human responses to the food stress are highly variable, those frequently involve intensification strategies. Intensification in terms of faunal resources can be related to the intensive harvesting of specific resources, resource diversification, use of low-preference foods and the adoption of new social strategies. All those factors might have played a role in the subsistence economy during the later stages of Indus occupation at those sites.

Thomas et al. have related the increase in exploitation of wild animals during the ‘late-Indus’ period in Gujarat to the demographic stress. According to them, the over-exploitation of animals in the ‘late-Indus’ period might have been due to over-population, as in that condition, people had to depend more on animal food for sustenance (Thomas et al. 1996: 305). Demographic stress is generally used to refer to the change in ratio of population to resources (Harris 1977: 187-188). It may be claimed here that the changes in demographic structure in and around the Indus sites in Gujarat could also be one of the significant factors to reflect on the animal-use strategy. The variables of population that could impact any site include either a rise in the number of people living at the site (internal population growth or migration) or limited access to resources due to shifting distribution of people around the site, but not at the site itself (Weber 1991: 165).

However, the local food stress and the pressure due to over-population may not be judged the only reason that necessitated changes in animal-use during the later phases of Indus occupation. According to Weber, the adoption of new social strategies and the external influencing factors at any site may also play an important role in affecting the subsistence strategies (Weber 1991: 166). For instance, a change in the social structure at the Indus site of Kanmer can be seen during the later phases of Indus occupation that revealed the Ahar type of white painted Black and Red ware and Gritty Red ware. That distinctive Ahar type pottery at Kanmer not only suggests existence of extensive exchange networks, but also emphasises the relationship between the Ahar and the Indus people. The exchange of ideas and products among them indicated substantial changes in social structure that took place during those phases. Based on that evidence, it is proposed here that those new forms of social and economic relations and the development of long distance exchange systems during the later phases of Indus occupation at Kanmer might also have played a significant role, not only affecting the process of food production and the demand for food products, but also changing food preferences.

In the context of scenario presented above, the overall increase in the number of ‘late-Indus’ settlements in north Gujarat has been interpreted as the increase of pastoralism during that period (Bhan 2004: 260). As seen above, Reddy’s palaeobotanical analysis at the ‘late-Indus’ sites of Oriyo Timbo and Babar Kot in Saurashtra, and Rissman’s observations of the annual growth ring of cattle teeth from Oriyo Timbo has also revealed the existence of cattle-based pastoralism. It is important to note that the detailed information regarding animal-based subsistence during the ‘late-Indus’ phase is limited to few sites only. More work is required to understand properly the animal-use patterns during that period. This has considerable implications for understanding the nature of cultural change in the South Asia.

Other Allied Technologies

Bone Artefacts

In addition to the large assemblages of food resources, many Indus sites have yielded a number of artefacts and tools made from the various animal skeletal parts, but such objects are poorly described in most of cases. (**Figs. 6.35 to 6.38**) Most of Indian archaeological studies on the bone artefacts focus on the typology, and there are only a few attempts to understand their production technology. That indifference may be attributed to several factors. First, only a limited numbers of 'bone workshops' have been excavated in the region. Secondly, poor retrieval techniques during excavations have resulted in the loss of waste products related to the bone-tool production. Thirdly, the facility for systematically analysing and presenting the bone artefact, as is generally available for ceramics or lithic materials, are virtually nonexistent. Fourthly, primarily the archaeologists study the bone artefacts, which, in fact, the archaeozoologists or the faunal experts should do. The excavation reports contain only brief descriptions of the bone artefacts. Consequently, such studies are not useful for understanding the technological aspect of tool manufacture. That is not the case only with the Indus period, but with all the cultural periods, except the mesolithic phase where some attempts have been made to understand the bone tool technologies (see Chapter 4).

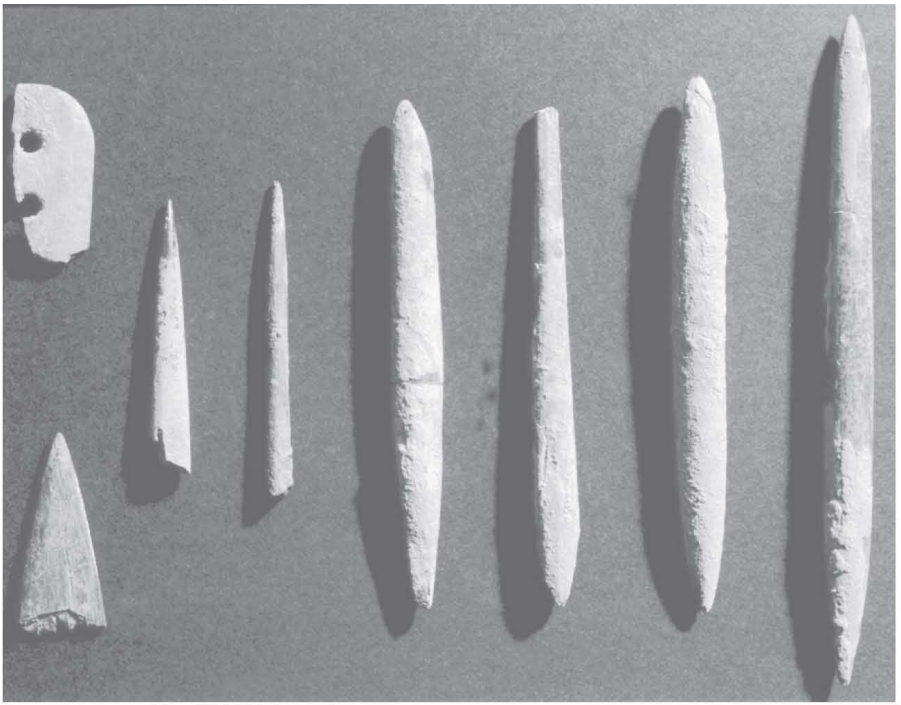

Fig. 6.35 Bone tools from Farmana, Haryana

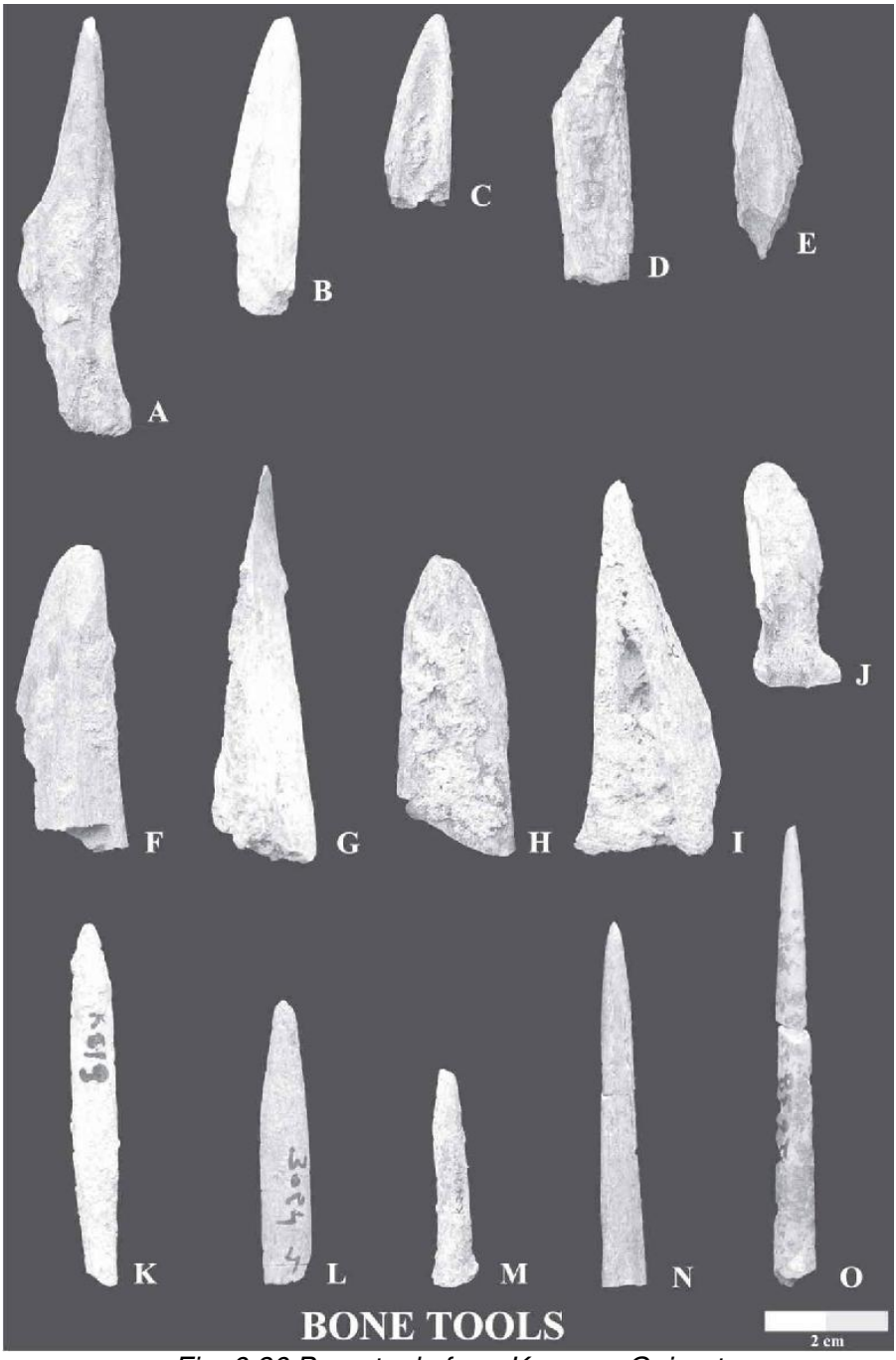

Fig. 6.36 Bone tools from Kanmer, Gujarat

Fig. 6.37 Bone handles from Bagasara, Gujarat (Courtesy: Prof. V. H. Sonawane)

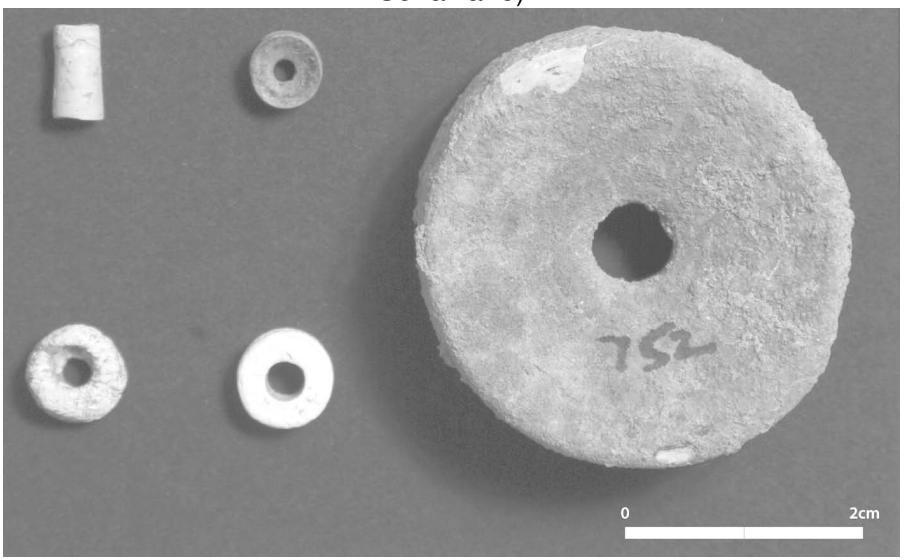

Fig. 6.38 Bone and shell beads from Kanmer, Gujarat

A look into the published data of bone artefacts from the Indus sites reveals great variety in typological terms. Animal bones were used for manufacturing many everyday objects, such as beads, bead spacers, bangles, hairpins and pendants, and dice used in gambling games. The careful manner in which those objects were prepared indicates the mastery of Indus artisans. Needles, weaving equipment and a number

of other small objects were also made, which do not fit in any typological scheme. In addition, inscriptions were engraved on the bone rods that may have had some sort of religious significance (Mcintosh 2008: 359).

However, the sheer variety of tools manufactured from the animal bones reflects its profuse use. Some of the major tool types recovered from the Indus sites include spearhead, point, awl, burnisher, antimony-rod, scraper, piercer, engraver, spatula and various types of digging tools. Those tools can be classified into various types, such as hunting or fishing tools, domestic tools and digging tools. Main uses of the domestic type of bone tools might have been in the processing and manufacture of organic artefacts, such as cordage, thongs, basketry, woven fabrics, mats and nets, meat and hides. In addition, the bones were also used as handles for the metal and flint tools. Furthermore, horns, antlers and even unmodified bones might have been used as the soft hammers for flint knapping.

While the bone workshops have not been identified in any Indus site so far, some sites have evidenced some sort of bone working activities within the site itself. For instance, at the Lothal site, Rao reports as many as 26 bone pins and awls of varying length, from five to 11.25 cm (two to 4.5 inches), having a single or double point, besides a stone anvil in a house located in the Acropolis area, possibly occupied by a a bone worker. Those bone tools were polished and had a rounded butt. (Rao 1985: 624)

Bone objects recovered from the Indus sites evidence careful planning in their manufacture. Each piece appears to have undergone initial shaping by cutting with either a stone or a metal tool, followed by polishing. While the archaeological records show that the Indus people had significant specialisation in bone tools, no effort to understand the technology involved to manufacture of those has been made, except by Sharma at the Surkotada site. He states that a single technique or a combination of techniques, such as percussion, splitting, flaking, cutting, notching, scraping, grinding and tempering was used for manufacturing bone tools. Splitting, flaking and scraping was most probably done with the help of stone tools, like chert and chalcedony blades, which have been found at Surkotada in large numbers. The sharp working edges of the tools were obtained by grinding the bones on a grinder.Steaming was done to get the desired curvature, and to strengthen, the whole tool or parts of it were tempered in the fire (Sharma 1990b: 344-356).

Technology of Transport Vehicles

Wheeled vehicles were one of the most important inventions that greatly revolutionised the human lifestyle. That is nowhere better illustrated than during the Indus civilisation in India. (**Figs. 6.39 and 6.40**) The terracotta carts and wheels found at almost every Indus site provide indirect evidence about the origin and development of an indigenous technology of making the wheeled carts. Nonetheless, from the days of Mohenjodaro and Chanudaro excavations, it was opined that the technology of wheeled transport originated in the west. Those opinions were based on the comparative study of terracotta models of carts and wheels of the Indus people with those of the contemporary civilisations. For example, Sir John Marshall says, 'As far, therefore, as the archaeological evidence takes us at present, the wheeled vehicle originated in Central Asia, and seems to have passed thence to the west about a millennium later' (Marshall 1931, Vol. 2: 555). Likewise, Mackay found the terracotta cart frames unearthed from the sites of Mohenjodaro and Chanudaro as being inferior to those used in Sumer. He states, 'From the model carts and chariots found at Sumerian sites and their representations in relief and mosaic, we can say that the type of chariot used in Sumer was definitely less primitive than anything yet found in ancient India' (Mackay 1943: 164).

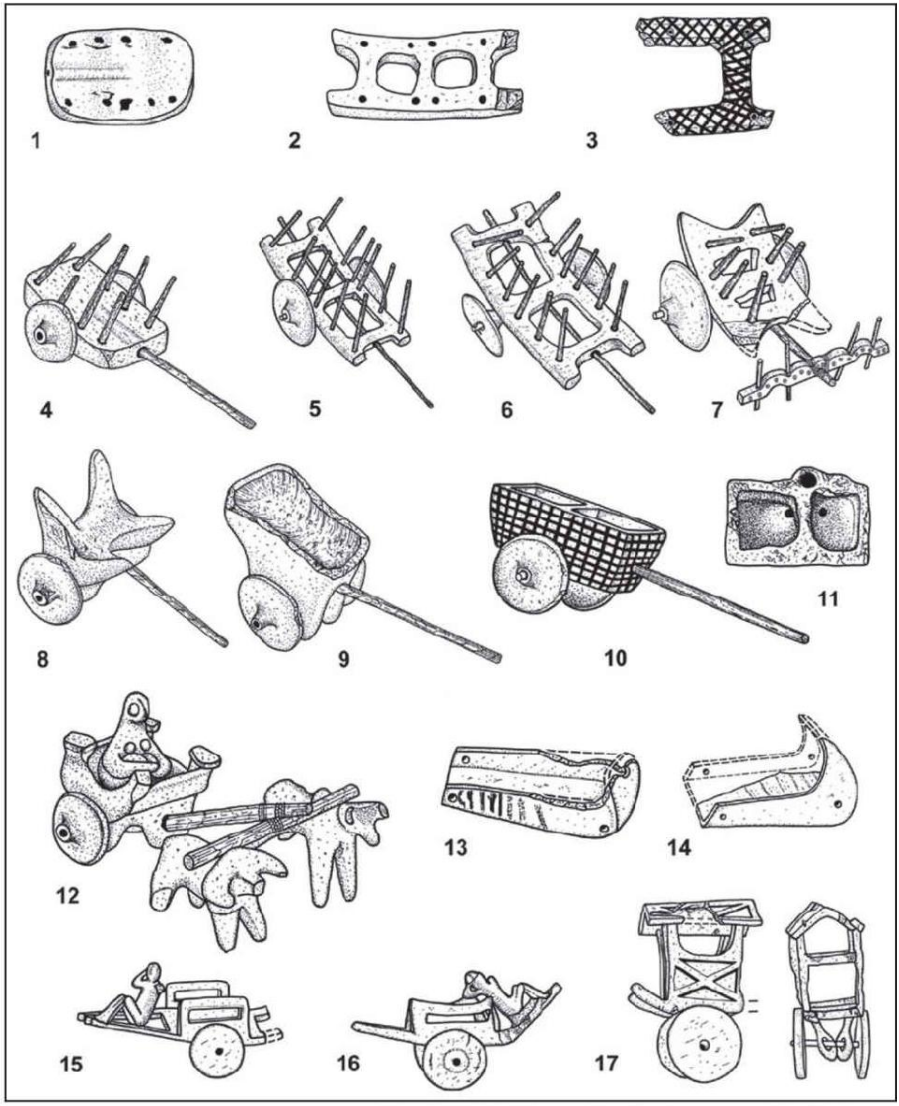

Fig. 6.39 Different kinds of carts used in Indus time (After Kenoyer 2009)

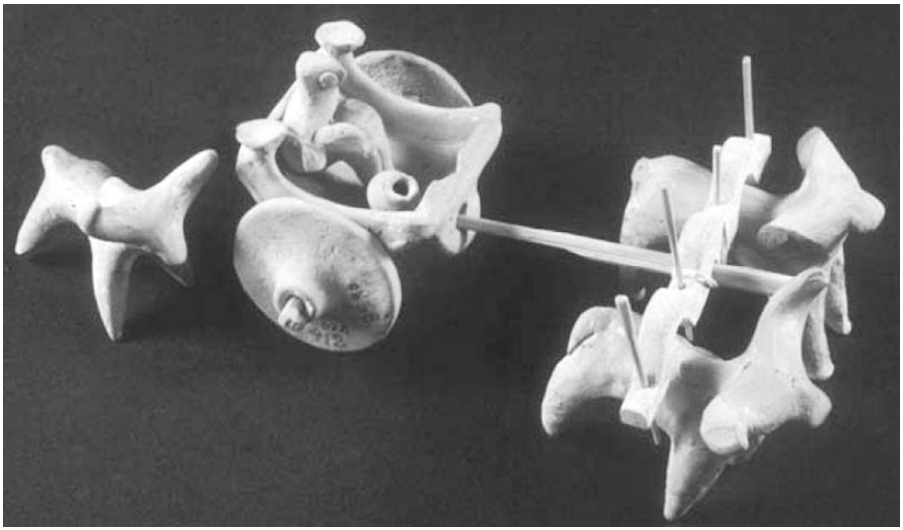

Fig. 6.40 Reconstruction of an Indus cart (After Kenoyer 2009)

However, contrary to those earlier models of the diffusion of cart technology from the west, Kenoyer's recent study of cart models and wheels discovered from the Harappan site has clearly shown that the process of bullock carts developed in the Indus Valley. That appears to be the result of invention of an indigenous technology rather than the diffusion of a technology from other regions. He found evidence of the possible use of model terracotta carts belonging to the period around 3700-3500 BCE during the Ravi phase, at the Indus site. That phase revealed humped bull figurines along with what appears to be a fragment of a model cart with a hollow frame chassis. That 'possible' fragment of a cart was discovered on a well-preserved floor of a house. According to him, that find from the Ravi phase should be taken as an evidence of the beginning of experimenting with the cart technology (Kenoyer 2009: 1-34). Kenoyer further supported this evidence by saying:

> The fact that all of the pottery during the early Ravi phase is hand-built and that in the later Ravi levels we see the introduction of wheel-made pottery could indicate that wheeled carts were in use prior to the development of the potter's wheel in this region…that no terracotta models of cart No carts or wheels dating to this early period have been reported from any sites to the west in Afghanistan or Central Asia, or even at the sites of Mehrgarh and Nausharo which are located at the edge of the Indus Plain.
>
> *Kenoyer 2009: 6,8.*

Further evidence to corroborate what Kenoyer have stated may appear as more areas of the Ravi phase are excavated.

In the Kot Diji phase (the 'early-Indus' phase, 2800-2600 BCE), Kenoyer reported seven terracotta cart fragments and 17 wheels from the site. Additionally, that phase revealed evidence of the introduction of three new types of carts, two of which become more widespread during the subsequent urban Indus phase (Kenoyer 2009: 9). Painted bull figurines with holes for attaching small wheels were also made during that period. That phase also revealed the evidence of laying out streets that were probably intended for carts. In fact, ruts of wheels have been recovered on one of the 'early-Indus' streets at the site. The presence of a wide variety of the non-local material in that phase indicates long-distance exchange, which was no doubt, facilitated by the advent of bullock cart transport. That evidence, when combined, shows that not only was the cart technology developed, but also that had become more popular in Kot Diji phase.

The 'mature-Indus' phase not only showed a significant increase in the numbers of wheels and terracotta cart fragments, but also revealed various styles and sub-varieties of both categories of artefacts. A large number of such artefacts have been recovered from all the four mounds at Harappa. In fact, fragments of carts and wheels have been recovered from almost all 'mature-Indus' sites. Those terracotta models can be classified into two main types: the two-wheeled vehicles and the four-wheeled vehicles. However, compared to the two-wheeled vehicles, four-wheeled vehicles are rare in the Indus civilisation. In addition to the ubiquitous terracotta cart fragments, there are also examples of two-wheeled models in bronze from Harappa and Chanudaro (Kenoyer 2009: 1-34; Mackay 1943: Pl. LVIII).

In the light of abovementioned discussion, it cannot be said with certainty that the technology of wheeled transport originated in the west. The emerging evidence from the site of Harappa has unlocked the indigenous development of this technology. From the preceding account, it is seen that the presence of the cart fragments during the Ravi phase at Harappa, was the result of indigenous invention.

Animal Puppets

A number of unique terracotta animal figurines (made as puppets) have been recovered from the Indus sites. Some of those figurines have separable, movable or changeable heads, hinged at the shoulder. Although, the head and rest of the body of such figurines are generally found separated, their unique manufacturing method indicates that those were made to fit together. Some others figurines have holes on the underside (usually in the abdomen bases) probably either to support sticks or probably for strings, that would have allowed

those to have separate, movable appendages (Clark 2003: 304-328). (**Fig. 6.41**) Some movable appendages have also been recovered. One of the most famous figures has a dog-like head and a pot-bellied human body with holes for attaching moveable arms (Kenoyer 1998). A long penis was once attached under the bulging belly, and a broken tail can be seen at the back of the figure. A hole at the base indicates that it was attached to a stick, probably to allow a puppeteer to manipulate the figure, while sitting behind a screen. Those kinds of toys appear to be a distinct innovation of the 'mature-Indus' period. According to Possehl, such figurines might have been a Indus delight, designed for entertainment or story telling or for something like puppetary (Possehl 1999: 176). Another interesting thing to note is that many examples of terracotta buffalo horns have been found with holes for attaching them to headdress. Generally, those horns are found in a broken state, but complete horns may have been from 10 to 20 cm in length. Such horns might have been attached to the actual headdress, worn by puppets or child performers. Full-sized headdresses might have actually been used with the real horns. Such practice is still common among the Muria Gond communities in central India.

Fig. 6.41 Terracotta figurine with holes, a puppet from Indus time
(Courtesy: Prof. V. H. Sonawane)

7.

Iron Age and Early Historical Period

THE IRON AGE BRIDGES THE GAP BETWEEN THE BRONZE AGE AND the early historical phase in the South Asia and, thus, the age of iron heralds a new era in human history. The iron brought a significant change practically in every sphere of life in the ancient civilisations all over the world. ‘Iron as an innovation represents a new line of development, a recombination of previously existing knowledge which resulted in an entirely new technical configuration’ (Wallace 1972: 269). However, the emergence of iron and its social adaptation has not been uniform spontaneous and smooth in ancient societies (Tripathi 2002: 287).

Although there are several Iron Age cultures in South Asia, such as the megalithic culture, the PGW culture, the Gandhar ‘grave culture’and others, yet nothing or very little of the early stages of development of iron technology in South Asia is known. In fact, the connotation of the term ‘Indian Iron Age’ has undergone significant change in recent years. While, the earlier framework for the early Iron Age in South Asia emphasised on diffusion and external stimuli as the major factor in understanding the transition to iron production, scholars are now trying to understand the development of iron technology within the subcontinent. Accordingly, one needs to consider the possibility that there could be different centres of iron technology, which developed independently over time in different geographic regions of the large Indian subcontinent (Agrawal and Kharakwal 2003: 215). While the Gandhar region (Pakistan), Ganga Valley and the peninsular India are culturally independent to each other, iron appears to have been used almost simultaneously in those regions around 1000 BCE (Tripathi 2002: 289). Keeping that fact in mind, many scholars have attempted to divide the early culture of Iron Age in India into several zones. For example, Tripathi has divided the Iron Age culture into five different zones, as (i) ‘Zone A’: northwestern India (including Pakistan), (ii) ‘Zone B’: PGW culture of north India, (iii ‘Zone C’: Black-and-Red Ware culture of northeast India, (iv) ‘Zone D’: Megalithic culture of central India. (v) ‘Zone E’: Megalithic culture of peninsular India (Tripathi 2002:

287-311).

Tripathi defines three clear-cut stages of the growth of iron technology in India: (1) Early Iron Age (from the earliest times to 700-600 BCE), (2) Middle Iron Age (700-600 to first century BCE) and (3) Late Iron Age (first century BCE to the historical period). According to him, 'Iron technology in India appears regularly from around the beginning of first millennium BCE at different cultures in different geographical locales. It is seen with chalcolithic Black-and-Red Ware in middle and lower Ganga plains, with Painted Grey Ware in the upper Ganga plain, with megalithic culture in Vidarbha and peninsular India' (Tripathi 2002: 296).

Settlements of the Iron Age appear to have been spatially diverse, with sites of variable sizes occurring in wide variety of settings. Evidences from some of the sites show that agricultural practices had gradually become more diversified and perhaps intensified during the Iron Age. Additionally, some of the settlements provide evidence of a specialised economic production. However, an adequate understanding of the faunal data recovered from the Iron Age and early historical sites has yet to be studied. A survey of literature on the faunal analysis reveals that although some promising work has been done still much is left to do if one has to reach a fuller understanding of the animal husbandry of the South Asian Iron Age. Further, based on the published reports, a clear-cut distinction between the Iron Age and the early historical levels is not always possible.

After providing this general outline, we now turn to a more detailed discussion on the archaeological evidence for the animal use during the Iron Age and the early historical period.

The Pirak Assemblage

The Pirak site is located in the north Kachchhi plains of Baluchistan. Casal and Jarrige excavated that site between 1968 and 1974 and identified three different cultural periods. The ‘Period I’ has yielded Pirak pottery (handmade bichrome-on-cream or buff slip with the motifs of multiple triangles, intricate lattice and so on, and a wheel-turned Grey or Black Ware), multi-roomed and well-built houses and other artefacts, indicating a continuity from the Bronze Age of Baluchistan. Bone tools recovered from that period indicate that bone tool industry was a well developed there. The ‘Period II’ was continuity of ‘Period I’, but with the introduction of some new shapes and fabrics. ‘Period III’ was characterised by the iron production. A number of other sites, such as Chashma Murad, Durkhan Malazai, Pathani Damb II, Sulaimanzai and others have been identified as those belonging to the Pirak culture.

It is suggested that site was first occupied around 18th century BCE (Jarrige and Santoni 1979: 19). While they assigned the beginning of iron at Pirak between 1200 and 1300 BCE, other scholars suggest that the beginning of iron started at somewhat later date (perhaps approximately 900 BCE) for which there are three very consistent radiocarbon dates (Possehl and Gullapalli 1999: 157).

Although, final faunal report of that site has not yet been published, yet the skeletal remains of camel (probably *Camelus bactrianus*), donkey (*Equus asinus*) and horse (*Equus caballus*) have been reported from ‘Period III’ at Pirak. Those animals seem to have been commonly employed for transport and communications. However, no faunal remains of those animals were recovered from the earlier periods, but the figurines of two-humped camels, horses and riders have been reported from ‘Period I’, dated between 1800 and 1500 BCE (Meadow 1996: 405).

The PGW Cultural Phase

In South Asia, the second urbanisation started in the monsoon ecology of the Ganga *doab* during the mid-first millennium BCE with the advent of iron technology. While OCP has been found in several places in the upper Ganga *doab*, it seems that OCP habitations could not grow to the sizable villages. That was perhaps the PGW culture, which may be given the credit of introducing iron in the Ganga basin. Krishna Deva and Wheeler were the first to identify the PGW pottery at Ahichchhatra, but Lal realised its true significance when he excavated the site at Hastinapur. To date, more than 700 settlements of the PGW culture have been found in the Indo-Ganga region, extending from Lakhiyo Pir in Sindh and Bhawalpur region of Pakistan in the west to Kosambi in the east, Punjab and central Himalay in the north to Ujjain in the south (Agrawal and Kharakwal 2003: 220). The PGW cultural phase, generally bracketed between 1000 and 600 BCE, was essentially a rural culture with simple moderate-sized habitations. The evidences of post-holes, remains of mud or mud-brick walls and the plastered reed or wood impressions at a number of sites hint that people were living in wattle-and-daub structures with (probably) thatched roofs. While the subsistence might have been based on agriculture, animals certainly played an important role in the overall subsistence economy.

Some of the PGW contexts from where faunal remains have been examined are Hastinapur 'Period II', Bhagwanpura 'Period IB', Atranjikhera 'Period II', Chak 16, Madina, Alamgirpur and Abhaipur 'Period III' and so on. At the site of Bhagwanpura, excavations revealed a two-fold cultural sequence, designated as 'Period IA' and 'Period IB'. Stratigraphically speaking, there is no break between the two periods. The PGW people had been living alongside the 'late-Indus' people in 'Period IB'. The study of faunal remains from those sites show that the inhabitants were keeping domestic animals, like cattle, buffalo, sheep, goat, pig, horse, ass and dog. Of those, cattle remains occur in large number, suggesting their importance. Terracotta bull figurines have been reported from a number of sites. Toy carts found in the excavations indicate the use of cattle as the draft animals. A number of charred tortoise shells have been recovered from the site of Bhagwanpura, suggesting that tortoise flesh was commonly eaten at that locality. The presence of terracotta net sinkers from the PGW contexts at Atranjikhera suggests that fishing was an important subsistence activity during the PGW period. The inhabitants of PGW period also hunted wild animals to supplement

their diet. In addition to the above faunal data, a large number of horse bones have also been reported from the PGW site of Thapli, situated on the right bank of River Alakananda in district Tehri Garhwal in Uttarakhand (Nautiyal et al. 1978-79: 94). However, that report does not mention anything about the presence of other animals. Evidences coming from a number of PGW sites suggest that PGW people had a strong agricultural base, with a section of society engaged in raising stock, especially cattle breeding. Hunting of wild animals and fishing also appear to have played a marginal role in the subsistence activities.

Sahu draws attention to the number of circular pits, containing charcoal, grains of charred rice and small fragments of animal bones, discovered in the early and middle layers of the PGW period at Atranjikhera. Those pits might represent the sacrificial fire pits (Sahu 1988: 238).

Many PGW sites reveal bone objects in large number, of those the arrowheads, points and sockets are the important ones. Less frequent is the occurrence of bangle, needles, comb, gamesman and hairpin and others. The ivory, shell and horn objects are rarely found. The site of Allahapur, located in Muradnagar town of Uttar Pradesh revealed the presence of both finished and unfinished products, indicating that the bone working activities were going on there. The artefacts recovered included arrowheads, stylus and points. Points dominate that assemblage and Dikshit has further classified those into various types, such the as double-ended point, tanged point, long socketed point, hollow point with iron filling, and the tang hollow point. According to him, the site was perhaps inhabited by the bone-tool workers, who supplied those to the nearby settlements (Dikshit 1970-71: 51).

Almost adjacent to the zone of classic PGW tradition is the BRW cultural zone. It lies further east, in the eastern part of Uttar Pradesh and Bihar. The painted BRW, associated with the Narhan culture (*c.* 1300-1000 BCE), was first brought to light at the Narhan site in the Ghaghra Valley of Gorakhpur district. Chattopadhyaya studied the faunal assemblage recovered from that site. He revealed a dominance of cattle bones (Chattopadhyaya 1994: 246-254). Another unique feature of the assemblage is the presence of a caballine horse of a uniform build.

The NBP Cultural Phase

A new stage of Iron Age culture appeared around sixth century BCE in the lower Ganga *doab* region, characterised by NBPW, which continued until the early centuries of Christian era. At certain sites, that stage was found to be contemporaneous with the late phase of Painted Grey Ware culture on the one hand and the megalithic cultures on the other. The NBPW culture spread over the geographical area larger than any other known to the Iron Age pottery did. That culture extended as far as Amravati, Dharanikota and Chebrolu (Andhra) in the south; Swat, Charsada and Taxila in the north; Bangarh and Chandraketugarh (Bengal) in the east; and Prabhas (Saurashtra) and eastern parts of Rajasthan in the west (Agrawal and Kharakwal 2003: 226). Agrawal suggests its expansion with iron technology through trade routes, while some scholars, like Ghosh and Subbarao associate the wide distribution of that ware with the Mauryan imperialism. However, the concentration of sites of that culture is in eastern Uttar Pradesh, Bihar and Bengal.

That was the period when iron technology was consolidated. There was not only a relative increase in the number of iron objects, but also a qualitative improvement. One also notices an increase in the number of agricultural implements, like ploughshare, spade, hoe, sickle, axe, and many others. It seems that subsistence-based agriculture increased at that juncture. There are evidences of double cropping and the cultivation of pulses also. Besides, the remains of large size storage bins and granaries have been found at a number of sites.

Faunal remains from the NBPW levels have been examined from a number of sites, such as Agiabir ‘Period III’, Atranjikhera ‘Period IV’, Hastinapur ‘Period III’, Malhar ‘Period III’, Rajghat ‘Period IB’, and Siswania. Animal bones in good quantities have been reported from all those sites. Despite marked changes in the pottery, there was little perceptible change in the faunal composition. As was the case during the PGW period, animal-based subsistence economy at those sites was dominated by cattle, followed by sheep and goats. Buffalo, pig, horse, ass and dog were the other important domestic animals. The data also indicated that the inhabitants at those sites also exploited wild fauna. Different varieties of deer and antelopes have been identified from those sites. The NBPW assemblage at Siswania has thrown light on the presence of pygmy hog. It may be recalled here that skeletal remains of pygmy hog were identified at the mesolithic

site of Damdama. Aquatic fauna like turtles, fish and molluscs were also an important part of the diet of those people. An interesting piece of evidence from NBP period at Abhaipur is hunting and the consumption of a migratory duck, the Eurasian teal (*Anas crecca*). This water bird visits the Indian subcontinent during winter.

One of the important issues related to the animal-based subsistence is the change from the pre-NBP cultural phase to the NBP phase, because urbanism occurred in the Ganga plain at least from 600 to 300 BCE, if not earlier, as has been conjectured by many scholars in recent years. The urbanism had its impact on the diverse economic activities and settlement patterns, leading to the growth of towns and cities with the different socioeconomic systems to sustain the population that probably was not confined only to hunting, gathering, fishing or rearing animals. We have diverse evidences, indirect of course, of those diverse economic set-ups from the literary sources, such as *Majjim Nikay*, *Anguttar Nikay*, *Digha Nikay* and *Manusmriti*. However, based only on the faunal data, it may be difficult to venture into this aspect. In most of the cases, the archaeozoological data is just of the preliminary nature, and it only provides a probable data on the species present at a particular site at a particular time.

The Megalithic Culture

The term ‘Megalith’ comes from the Greek words *megas* meaning ‘huge’ and *lithos* meaning ‘stone’. The megaliths have a widespread distribution in both Europe and Asia, including Japan, Korea, China, Indonesia, Malaysia, Gulf countries (southeastern Arabia), Pakistan, India and the northern parts of Sri Lanka. The European megaliths are much older than the Asian ones, and cover a broad time bracket that ranges from 5000 to 2000 BCE. Those are quite often associated with the early farming cultures. However, the megaliths in the Indian subcontinent are not older than the first millennium BCE, barring a few, such as a cist burial in the central Himalay, which has been dated to the middle of third millennium BCE and the megaliths of Kashmir that have been assigned to the mid-second millennium BCE (Agrawal et al. 1995: 81-85). The chalcolithic Megaliths of the southern Uttar Pradesh have also been placed in the second half of second millennium BCE. In the earlier stages of research, the term ‘megalith’ was used to designate the large stone monuments only. However, in the last five decades, considerable research has been carried out across the Indian subcontinent and many important publications have appeared, in which the term ‘megalith’ has invariably been used for the burial sites and other structures associated with or without BRW, belonging to the megalithic culture of Iron Age. In India, megalithic burials have been found in Kashmir, central Himalay, the Vindhyas, Vidarbha, Deccan, Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh of the peninsular south. It is important to note that some megalithic traits are still in vogue among some indigenous groups in Odisha, Bastar, Chota Nagpur, and among the Nagas and Khasis of the northeastern region of India.

Kashmir Megaliths

Excavations at Gufkral in Kashmir Valley by the ASI have brought to light a megalithic occupation associated with iron. At Gufkral, ‘Period II’ is designated as the megalithic and ‘Period III’ as the historical period. As mentioned above, the megaliths of Kashmir have been assigned to mid-second millennium BCE. However, as noted in Chapter 5, it is important to note that there is an underlying neolithic deposit at Gufkral, and we know almost nothing about the quantity of iron recovered from ‘Period II’.

Sharma studied the faunal remains recovered from that site Sharma

(1979-80: 1925). The megalithic period at Gufkral revealed the presence of cattle, sheep, goat, pig, dog, fowl and ibex. The remains of animals, like cattle, sheep, goat, pig, dog and fowl have also been recovered from the succeeding historical period. While no wild animal has been identified from that period, cat and rodents made their presence felt in the assemblage. The megalithic period at the site also brought to light a good number of animal bone tools made, important among those include handles (mostly made from the tibia of sheep/ goats), arrows and sockets.

Vidarbha Megaliths

The region of Vidarbha forms the northeastern cultural and administrative division of the present state of Maharashtra. The megalithic culture of this region is spread over six districts (Nagpur, Bhandara, Chandrapur, Gadchiroli, Wardha and Amravati). **(Fig. 7.1)** The megalithic settlements of Vidarbha region can be dated approximately to between 900-300 BCE. Of all types of megalithic burials, stone circles are the most dominant in that region. Stone circles, with cairn packing, are known in large number from the sites of Junapani, Khapa, Mahurjhari, Naikund, Borgaon, Khairwada, Bhagimohari and Raipur. The grave goods recovered from those megalithic circles include personal items that might have belonged to the deceased persons and objects that were looked upon as necessary for the proper conduct of the funerary ceremony by those carrying out the rituals. In addition to those megalithic burials, a few habitation sites have also been excavated, such as Paunar, Kaundinyapura, Takalghat, Khairwada, Naikund and Bhagimohari. Archaeological investigations at those sites have yielded cultural material that helped us to understand the life of those megalithic people.

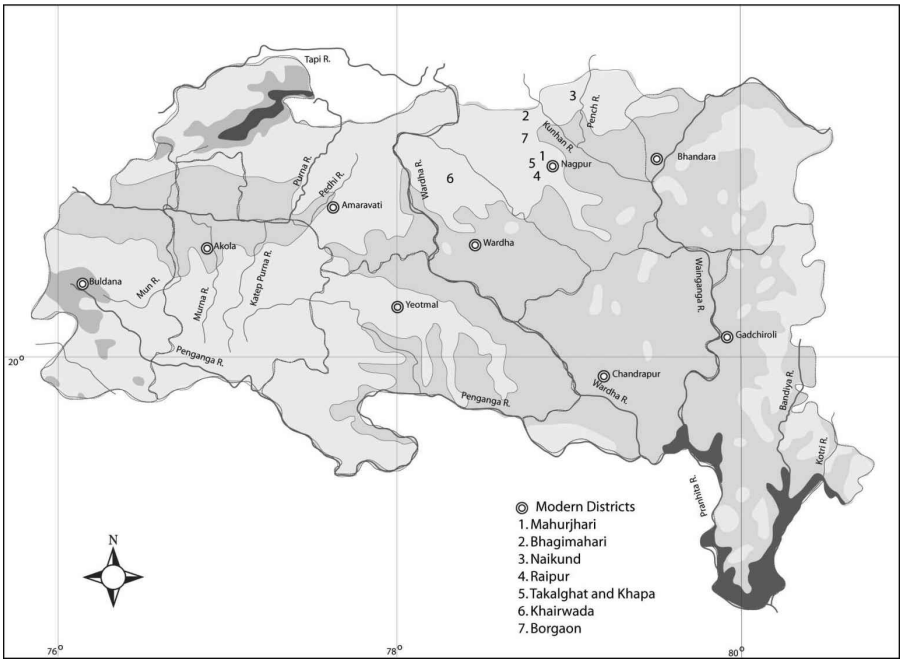

Fig. 7.1 Map showing megalithic sites in Vidarbha (Courtesy: Gopal Joge)

Subsistence Strategies of the Vidarbha Megaliths

The faunal remains from the megalithic habitation sites of Naikund, Tharsa, Paunar, Kaundinyapura, Khairwada, and Bhagimohari mostly comprise bones of the domestic animals, which include cattle, buffalo, sheep, goat, pig, horse and dog. Besides, a number of wild mammals, birds and reptiles have also been identified from the faunal remains. Thomas suggests that the economy of Iron Age was dominated by the cattle pastoralism, as the cattle bones recovered from the settlement sites indicate, but the people had also adopted a combination of stockbreeding, farming, hunting and fishing (Thomas 1992a:75-79). The identification of a new breed of cattle in the Iron Age phase at Veerapuram is a significant finding. In the neolithic period, cattle were smaller, while the type introduced during the Iron Age might have been the ancestor of the typical Kurnool breed that was exported to the West during the early part of 20th century. The remains of birds (fowl, goose and crane) have also been reported from Bhagimohari and other sites. One interesting observation related to the bird remains from Bhagimohari is that those outnumber those of the sheep, goats and pigs in some of the strata. Thomas thinks that bird hunting might have been one of the major subsistence activities at that site (Thomas 1992a: 75-79). Some of the habitation sites have revealed the presence of a large number of bone tools, which has been ascribed to

the scarcity of metal. The faunal species of the megalithic phase and the subsequent early historical phase were almost same.

Horses in Vidarbha Megaliths

The partial burials of horse remains have been recorded in all the megalithic sites excavated in Vidarbha. Those remains mostly consist of the lower extremities of limb bones, skull and mandibles. The frequent burials of such selected horse bones may suggest possible symbolic significance of those body parts. The importance of those in the funerary or other ritual contexts is obvious, even if their interpretation may be presently difficult. It seems that the horse was butchered elsewhere and only the selected portions were buried in the megalithic circle, which is the main megalithic burial type in Vidarbha. Vaidya and Goyal state that the skulls of the horses could have been periodically displayed in front of the circles during ancestral rites or perhaps decorated to create a truly awesome sight during initiation ceremonies (Vaidya and Goyal 2012: 238-248). Significantly, one of the graves at Naikund offers an interesting deviation from the aforementioned pattern. That burial revealed a solitary evidence of cattle bones in the megalithic burials.

Thomas has made some interesting observations regarding the absence of post-cranial bones of the horse in those burials. The presence of bones and teeth of horses along with kitchen refuse at the megalithic habitation sites of Naikund and Bhagimahri led him to raise the possibility of consumption of the rest of the horse in a death ceremony by the near and dear ones of the deceased person (Thomas 1992b: 133136). According to Vaidya and Goyal, partial burials of horses also need to be seen against the background of circulation of rest of the bones as relics among the living, or of their use in other ceremonial contexts (Vaidya and Goyal 2012:239).

The disintegration of skeletal material of horses created a major problem in the identification of age and sex of the animal. While the age could be was identified in some of the burials, the relative frequency of such identifications has been very low. Rao was able to identify a 10-year-old horse, based on the smaller and more rounded marks of the infundibulum on incisors in one of the megalithic burials at Mahurjhari (Rao 1973: 65). Thomas reported the presence of three horses between the ages of four to six years at the same site. He was also able to identify a horse of 3.5 - 4.5 years of age in one of the burials at the site of Raipur (Thomas 1992a: 76; 1992b:133). Other examples, where the ages of horses have been established come from the megalithic burials at the sites of Khapa, where a more than five

years old horse was identified (Rao 1970: 77), and at Khairwada, where two horses between the ages of 3.5 and five years were found (Thomas 1992a: 76). Those are the only examples where the age of the horse has been ientified. It is difficult to ascertain sex, for the extremely limited data is available. The only case where both male and female horses have been reported comes from the megalithic burials at Mahurjhari (Thomas 1992a: 76). Against that background, it can be said that sex does not appear to have been a discriminating factor, as male and female horses were buried in the megaliths. The same cannot be said about the age, as most of the horses seem to be sacrificed between the ages of 3.5 to six years. Nevertheless, it has to be conceded that information on age and sex of horses interred within the megaliths is entirely inadequate for any discussion.

A number of ornaments and gears for horses in different states of preservation were also discovered in the megalithic burials of Vidarbha. The most commonly encountered ornaments include domical and conical bells and headgears. **(Figs. 7.2 to 7.6)** The headgears were made of thin sheets of copper, and some of those were such as could be fitted over the face of horse. Most elaborate and beautiful 41-part ornamental horse headgear was recovered from the site of Raipur (Megalith 2, Locality 4). That was made up of the 13 hollow tubular pipes, 12 leaf shaped pendants, 11 rounded buttons, three conical bells and two beautiful pendants (Deglurkar and Lad 1992: 147). In addition to the horse ornaments, a number of iron bridle bits have also been recovered from almost all the megalithic burial in Vidarbha **(Fig. 7.7)**. Ramachandran has broadly classified those bridle bits into three types: (1) simple bit with rigid mouthpiece, (2) horizontal rigid mouthpiece with looped nose-bands, and (3) linked bits (Ramachandran 1961: 170). However, no specific typological study of the horse bridles is presently possible, because of the nonavailability of enough bridles for that purpose.

Fig. 7.2 Horse

ornament – copper bell, from Mahurjhari (Courtesy: Deccan College, Pune)

Fig. 7.3 Horse

ornament – headgear, from Mahurjhari (Courtesy: Deccan College, Pune)

Fig. 7.4 Horse

ornament – copper bell, from Mahurjhari (Courtesy: Deccan College, Pune)

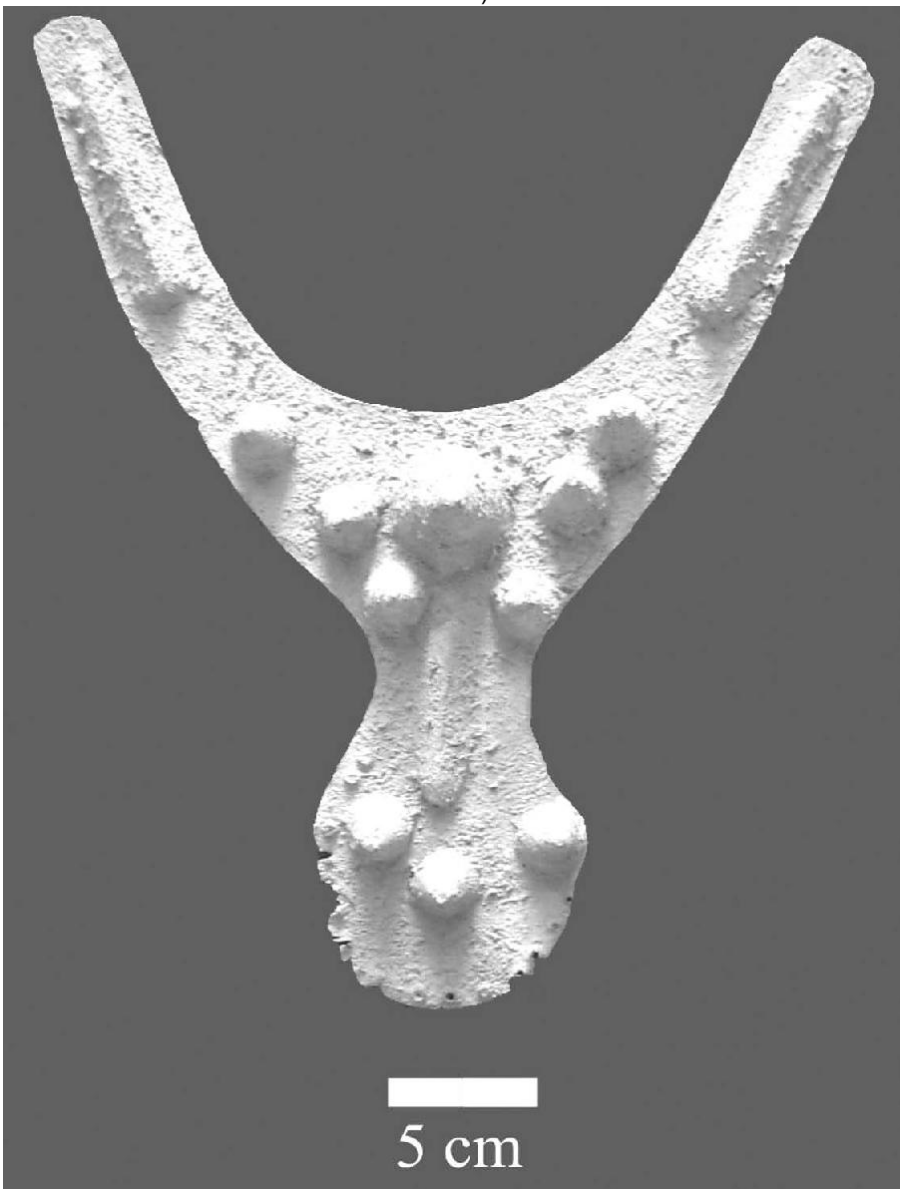

Fig. 7.5 Horse ornament – copper bell, from Mahurjhari (Courtesy: Deccan College, Pune)

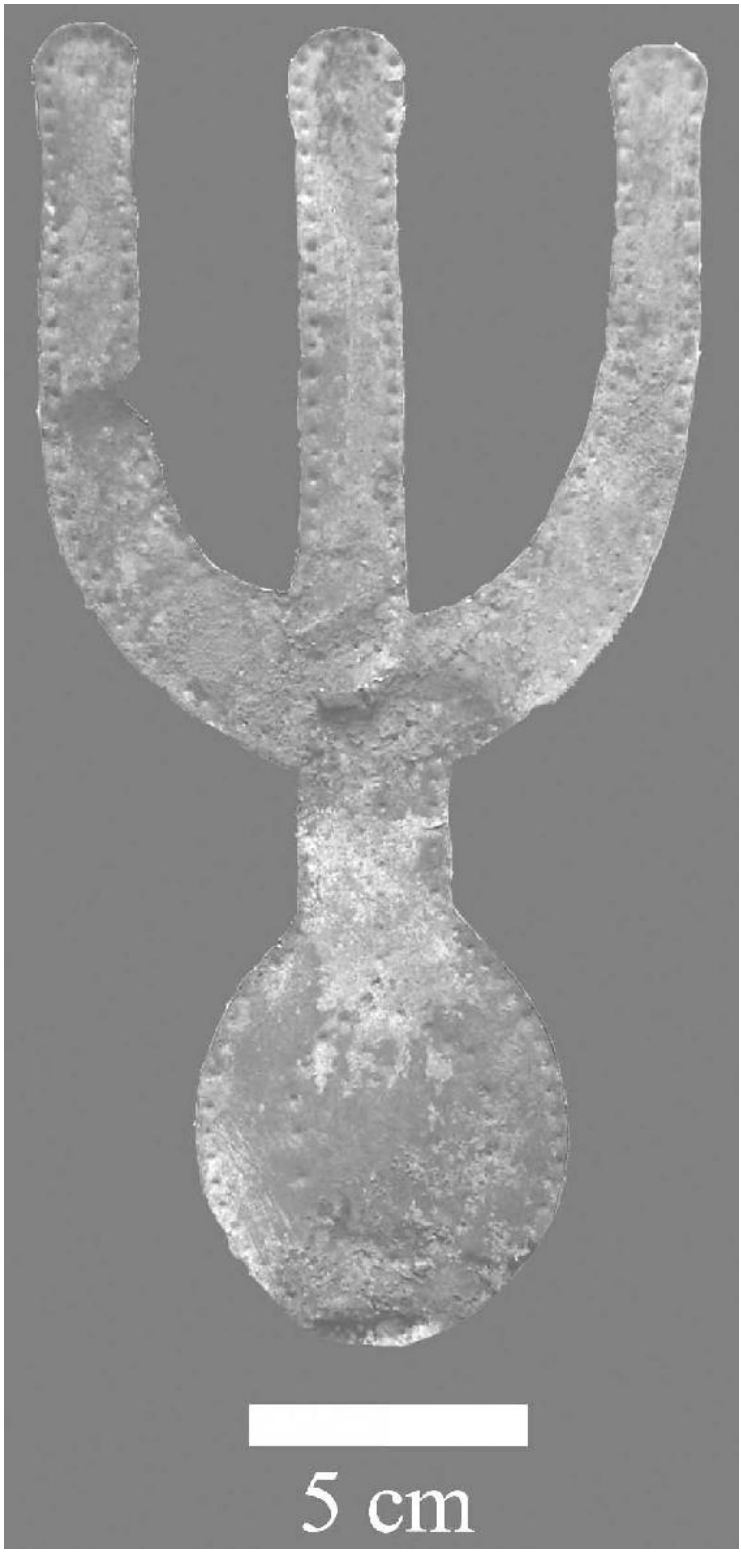

Fig. 7.6

Horse ornament – copper bell, from Mahurjhari (Courtesy: Deccan College, Pune)

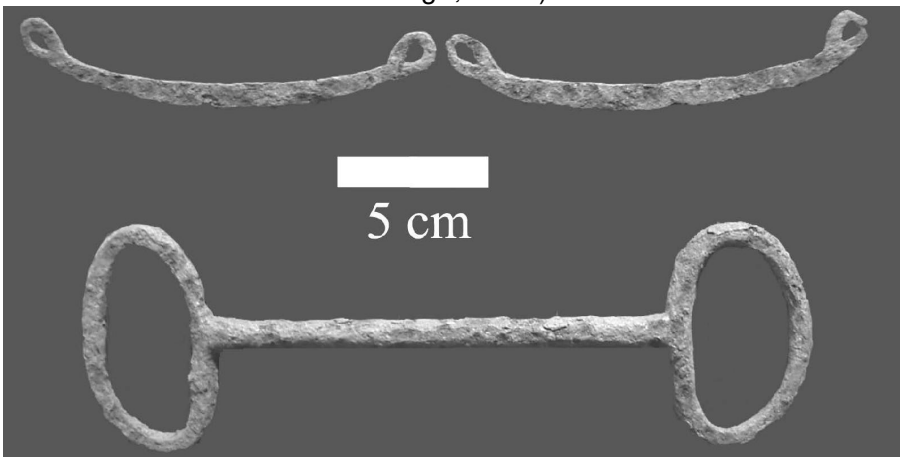

Fig. 7.7 Horse bridle bits from Mahurjhari (Courtesy: Deccan College, Pune)

Dietz states that the sensory organs and nerves are concentrated on the horse's head, and placing the bridles in that area has the greatest effect on the horse. The bridles also make it possible to pull the head of the horse around by force to a certain degree, as horse's neck is relatively unstable due to its length. The presence of horse, horse ornaments or bridles as the grave material might be viewed as an indication of horseback riding. That evidence may clearly indicate that the megalithic people of Vidarbha had developed such a kit, which was appropriate for the best horsemanship and horse riding (Dietz 2003: 191).

The presence of skeletal remains of horse along with horse ornaments and bridle bits clearly show the socio-cultural significance of horse in the megalithic culture of Vidarbha. However, a closer look at that evidence does not indicate only one practice; it also signifies different ways of dealing with the dead. It is clearly seen that the association of horse and other horse-related artefacts with the dead in the megalithic circles of Vidarbha differ from burial to burial. While some burials revealed the evidences of both, the horse bones and horse ornaments, some others revealed either the presence of horse bones or the horse ornaments (see Appendix 2).

The horse was certainly a precious animal; hence it would not have been butchered without serious reasons. Generally, the presence of horse in the megalithic circles is assumed to symbolise a special status related to horse-ownership and horse riding. There is no doubt that the burials revealing horse remains must have belonged to the

persons having a different or special status. On the other hand, the horse may also be considered as a symbol of authority. That authoritative power could have been embodied by keeping horse bones and other horse-related artefacts in the burials (Vaidya and Goyal 2012: 238-248). Nevertheless, it may be difficult judge the rank distinctions only on this basis.

While the skeletal remains of horses have been reported from the habitation sites, the frequency of horse bones is lesser than that of other animals. It is curious to see such a low representation of horses in the habitation sites, as the megalithic burials have not only revealed skeletal fragments of horses, but also a rich repertoire of horse-related artefacts. Perhaps, the horse was a very important animal in the society, playing a significant part in people's lives. Vaidya and Goyal have discussed some of the important and direct consequences of the presence of horse during the megalithic culture (Vaidya and Goyal 2012: 238-248). **(Fig. 7.8)** The same are summarised hereunder:

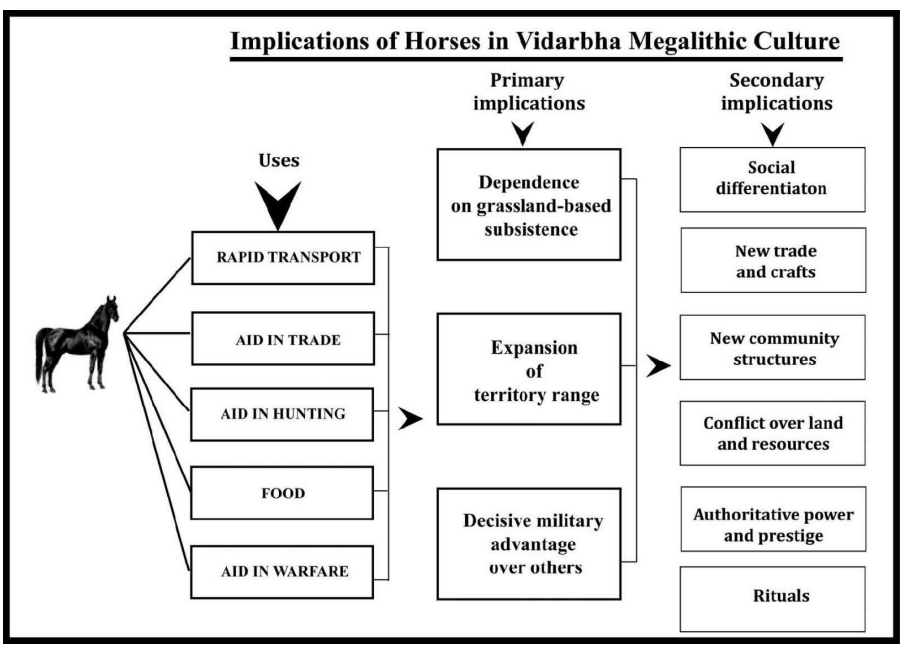

Fig. 7.8 Implications of horse in Vidarbha megaliths (After Vaidya and Goyal 2012)

1. The speed of horse must have helped in the rapid transportation of goods and people from one place to another. Tilok Thakuria in his dissertation states that the beads found in the megalithic burials were not manufactured only in Vidarbha, but were also procured from the southern and northern parts of India. Although cattle transport might have been used for that purpose, but the

faster horses would have proved more useful. Similarly, the exchange of finished goods, as iron tools and copper artefacts from one place to the other in Vidarbha could also have been done by using cattle-carts, but horses might have been employed for transporting those to the distant places.

2. The swiftness and fearlessness of horses made them excellent mounts for warfare and hunting. Excavations at the habitation sites of Naikund, Bhagimohari, Khairwada, Takalghat and Tharsa have yielded a considerable number of bones of wild animals. In addition, the megalithic burials have revealed a number of artefacts that may be related to the hunting activities. It shows that hunting wild animals (for their meat) was an important part of the subsistence activities of the megalithic people. In that activity, the horses might have played important role.
3. The use of horse contributed to the growth of technical and economic activities. The megalithic burials have revealed a number of horse ornaments and bridle bits that are related with the safety of the rider. Manufacturing those artefacts requires expertise and precision. Understandably, manufacturing those artefacts might have inspired a new craft specialization—of making horse-related ornaments and outfits—not known to the earlier cultures.
4. The *Ashvashastra* text, assigned to the end of first millennium BCE, deals with various aspects of horses such as selection, anatomy, breeding, training, maintenance, psychology, diseases, medicines, and horse equipments (bridle bits, shoes, eyepiece, whips and others). The qualities of a good horse rider are also described in that text in detail. The author of that text is traditionally believed to be Nakul, the fourth of Pandav brothers, who was well known for his skills in examining horse. Whatever the tradition, it can be safely said that the acute science of horse management had developed in the second half of the first millennium BCE. The presence of horse ornaments and bridle bits in the megalithic burials along with the other associated status and warrior oblects suggests that the horses were used as mounts by the megalithic society, perhaps on a large scale. Deo points out that the Kennedy and Burrow's examination of the human skeletal remains from the megalithic burials of Vidarbha revealed the incidence of massive pilastering of the linea aspera of femora in case of two males, which might have been due to horse riding (Deo 1985: 93). Those evidences induce one to believe the beginning of acute sciences like *Ashvasastra* from the past horse riding and rearing traditions of

the megalithic period.

5. It may also be assumed that a separate social and economic class might have emerged for taking care of the horses; instead of leaving that work to the cattle and sheep keepers. That may suggest the social and economic dynamics of the megalithic people

The Megaliths of Southern India

The important megalithic sites in southern India include Pochampad, Sanur, Maski, Brahmagiri and Nagarjunakonda. The faunal remains from those sites have been analysed. Alur studied the animal remains recovered from the megalithic burials at Pochampad, located on the right bank of Godavari River in Nizamabad district of Andhra Pradesh, and recovered well-preserved animal bones from the burial. The identification of those bones revealed the presence of cattle, sheep/ goat and horse. Of those, cattle remains were numerically superior. One of the noteworthy features of that assemblage was the recovery of a complete horse skeleton in one of the burials (Burial No. 2). That skeleton was lying buried in a natural position and none of its bones bore any marks. The age and sex of the animal is not given in the report. That burial also revealed a stirrup, which not only suggested the use of saddle, but also the presence of well-developed riding kit at that time. In another burial (Burial No. 1), a complete skull of a female horse was recovered. Based on the tooth wear pattern, he estimated the age of that mare to be about four-and-half years. Burial No. 3 brought to light the scatter of a few animal bones on a rugged floor, which might represent some sort of offering in a ritualistic ceremony (Alur 1979a: 63-66).

The megalithic site of Sanur, dated between third and second century BCE, is located in district Chingleput. Bose conducted the faunal analysis abd studied the animal remains recovered from the burials. Tha analysis revealed the presence of cattle, sheep, goat (*Capra* sp.), wolf or hyaena and fowl (*Gallus* sp.). No skeletal horse remains, but iron horse bits were recovered from the two burials. In addition, 18 shell objects (circular discs and different types of beads) were collected from one burial. All of those can be associated with the burial offerings (Bose 1959: 40-42).

Nath identified and studied the megalithic site of Maski, located in the Raichur district of Karnataka. The analysis conducted on the faunal remains recovered from that site revealed the remains of sheep, cattle and domestic ass. A fragment of the third metatarsal of an ass was found in the faunal assemblage from a superficial deposit associated

with a menhir. The age and sex of the animal could not be identified because of the fragmentary nature of the bones. The site also revealed the buffaloes and sheep remains of the historical period (Nath 1957: 122).

Nath analysed the faunal remains from the megalithic burials at the Brahmagiri and Nagarjunakonda sites, which revealed the remains of cattle, buffalo, sheep and goat. In addition, the remains of *chital* and domestic fowl were also recovered in the assemblage at Brahmagiri. An early historical context has also been recognised at the site of Nagarjunakonda. The analysis of the faunal remains recovered from that context brought to light a number of animal species, which include both domestic and wild animals. In addition, a number of fish bones and varities of molluscan shells have also been identified (Nath 1963: 1-63).

Other Iron Age and Early Historical Sites

Western and Central India

Studies have been done on the faunal remains from important sites in western India. Among such sites are Nagara, Jokha, Dhatva, Nagda, and Kanmer have been. The results of those studies are briefly discussed hereunder:

The Nagara site is located in Khaira district of Gujarat. The excavations at that site revealed a three-fold cultural sequence. The Iron Age people inhabited that site between sixth and fifth century BCE 'Period I'. They appear to be the first occupant of that site. The settlement began to grow around fourth and third century BCE 'Period II' and that gradually was transformed into a large town by the early centuries of Common Era 'Period III'. Shah studied the faunal remains recovered from the site.

The 'Period I' revealed the evidence of cattle, sheep, goat, pig, ass, dog, mongoose, cheetah, nilgai and fowl. Those animals have also been identified from 'Period II', besides the buffalo, camel and deer were found in the assemblage of 'Period II'. Animals identified from 'Period III' included domestic mammals (cattle, buffalo, sheep, goat, pig, horse, camel and dog), wild mammals (deer, nilgai, mongoose and cheetah), rodents (common house rat and bandicoot rat), fowl, turtle and fish. The evidence of fishing at the site came in the form of a fishhook from 'Period III'. In addition to those mammals, varities of marine molluscan shells have also been identified from all the periods. Shells like *Olivia nebulosa* and *Nerita* sp. were probably used as food. Among mammals, cattle seem to have dominated the faunal assemblage in all the periods. The impression of wheel tracks on the layers of 'Period III' indicates that cattle might have been used for draught purposes. Additionally the presence of a number of young cattle in the assemblage indicates that dairying may also have been an important subsistence activity. While the camel is a non-food animal, Shah recorded evidences of profuse chopping marks on camel bones, suggesting that it was probably consumed at that place. Animals, like horse, ass and camel might have not only played an important role in trade and communication, but also have helped the settlement to grow in commercial importance (Shah (1968a: 152-163).

Excavations at the Jokha site, situated in the Surat district of Gujarat,

brought to light on two cultural periods. The ‘Period II’ at the site has been designated as the early historical period, tentatively dated to the fifth or fourth century BCE to CE third or fourth century. Shah studied the faunal remains unearthed at the site. She identified the presence of cattle, buffalo, goat, pig, dog, *barasingha, chital*, hog deer, nilgai, hare and rodents (common house rat and bandicoot rat). In addition, her analysis also revealed the presence of reptiles (monitor lizard, crocodile and turtle) and birds (pigeon and cattle egret). Not even a single fragment of fish bone was recovered from the site. The site revealed a good number of bones of wild animals, and it seems that hunting of wild animals was a frequent phenomenon. That period also revealed the presence of two bone points and five terracotta animal figurines (Shah 1975: 57-60).

Nagda, another important site, is located in the Chambal Valley. The site revealed a cultural sequence divisible into three periods: ‘Period I’ (the Chalcolithic), ‘Period II’ (Iron Age, 850-500 BCE) and ‘Period III’ (early historical, 500-200 BCE). Nath studied the faunal remains recovered from that site (Nath 1966: 79-89). The ‘Period II’ assemblage revealed the presence of cattle, buffalo, sheep, goat, pig, cat, sambar, turtle, molluscs and fish. The ‘Period III’ revealed the presence of almost the same species of animals as in ‘Period II’, besides *barasingha*, crocodile and the common house rat. As is the case of most of the Iron Age and early historical sites in India, cattle dominated the assemblage, followed by sheep and goats. No other significant information can be drawn from the faunal report, and it seems that the inhabitants of the site were practicing a mixed subsistence economy.

The faunal remains recovered from the early historical levels at Kanmer (in Kachchh) have been studied by authors. As is the case with the other early historical sites in this region, the early historical assemblage at Kanmer revealed the presence of both, domestic mammals, such as cattle, buffalo, sheep, goat and pig, and wild mammals, such as deer, antelopes and the Indian hare. Bones of reptiles, birds and fish also found in the assemblage, but not in large numbers. The bones of cattle dominated the skeletal assemblage, followed by the sheep and goats. During the early historical time at Kanmer, cattle was not only used as a source of meat, but also used for secondary purposes. Kanmer appears to have emerged as a major industrial town once again during the early historical period, and the transportation by bullock carts might have played a major role in the trade and communication.

In addition to the data discussed above, some interesting evidences

come from the site of Devnimori. That site is located in Sabarkantha district of Gujarat. It appears to have been occupied during the Kshatrap period (second-fourth century CE). The site revealed the evidence of foot impressions of some bovine species and the dog on bricks laid for the construction of a *stoop* and the *vihar*. Those animals probably left behind their imprints on the un-burnt bricks, while those were being dried before firing. Shah studied those footprints and found out those to be of a normal pariah dog. The foot impressions of bovines, according to her, may belong to either the cow or buffalo. A few animal figurines of the humped bull and elephant have also been found at the site (Shah 1966: 172-173).

Northern Deccan

The plateau region in south India between the Narbada and Krishna rivers has been traditionally known as the Deccan. Its northern part boasts of some of the most important early historical sites in India. The Kaundinyapura, Bhokardan, Nasik, and Nevasa are among the important sites that have revealed the faunal remains. A brief description of those remains and their analyses is presented below.

The Kaundinyapura site is situated in Amravati district of Maharashtra. Excavations at that site yielded six chronologies (i) 'Period I': Megalithic, (ii) 'Period II': pre-Maurayan, 800-600 BCE, (iii) 'Period III': Maurayan, 300-100 BCE, (iv) 'Period IV': Satavahan, 150 BCE-CE 200, (v) 'Period V': late Satavahan, CE 200-250, and (vi) 'Period VI': Medieval, CE 1300-1600. Shah studied the faunal remains unearthed at the site, which revealed the presence of cattle, sheep, goat, pig, ass, elephant, dog, deer and turtle. While the remains of *Equus* and turtle were found only in 'Period IV', bones of sheep and goats were found to be absent in 'Period III'. The rest of species were found unevenly distributed in all cultural periods. The remains of cattle are found to be predominant in the assemblages of all the periods. One of the noteworthy features of the faunal assemblage at the site is the complete absence of horn cores of cattle, sheep and goats. The site also revealed a number of bone artefacts. Of those, two bone combs from Satavahan layers are worthy of mention. The same layers also revealed two bone pieces that were beautifully carved with the bud shaped designs. Other bone artefacts include points for joining wood, arrowheads, and some tools probably associated with weaving. The excavations at the site have also thrown light on the evidence of shell activity (Shah 1968b: 148-157).

The site of Bhokardan is located on the right bank of River Kelna in Aurangabad district of Maharashtra. Based on the relative stratigraphy

and other associated remains, two cultural periods have been defined at that site. The ‘Period I’ is further subdivided into ‘Period IA’: pre or early Satavahan, third-second century BCE, and ‘Period IB’: the Satavahan, first century BCE to CE second or third century. ‘Period II’ is assigned to post-Satavahan: CE third century onwards (Deo and Gupte 1974: 17-18). The faunal remains from that site revealed the presence of a large number of species that included cattle, buffalo, sheep, goat, pig, dog, fowl, *barasingha*, elephant, common house rat, turtle and fish, besides a good number of mollusc species, such as cowry, shank shell, and the freshwater bivalve and freshwater mussel (Rao 1974: 225-233).

Excavations at Nasik, an important site in Maharashtra, brought to light a fourfold cultural sequence: ‘Period I’: the Chalcolithic, ‘Period II’: the early historical), ‘Period III’: the period of Roman contact, and ‘Period IV’: the medieval. George studied the faunal remains from the early historical period (400 BCE to CE 50), and revealed the presence of cattle, buffalo, sheep, goat, pig, nilgai, sambar, *chital*, four-horned antelope, rat, common langur and turtle, besides a good number of molluscan shells (George (1955: 142-143). Another important feature of that site was the presence of an extensive bone industry. A large quantity of bone points were found littered all over the early historical layers. Banerjee studied the bone tool assemblage and reported 17,868 broken pieces and 1,499 workable specimens. Almost all the bone specimens evidenced flaking and polishing, but some broken specimens showed signs of burning. It seems that the tips of the bone points were fired to be harden (Banerjee 1955: 121130).

The site of Nevasa is located on the right bank of Gravari River in Henagar district of Maharashtra. The animal bones coming from two periods: ‘Period IV’: early historical, 300 BCE-CE 100 and ‘Period V’: late historical, CE 100-300) from the site were studied in two phases. Eapen studied the bones collected during 1954 field season, and Clason examined the bone collection of 1955-56. Those analyses revealed the presence of cattle, buffalo, sheep, goat, pig, horse, donkey, dog, *barasingha*, *chital*, sambar, nilgai, four-horned antelope, blackbuck and elephant; the reptiles (mainly the tortoise), fish; and freshwater marine shells (Eapen 1960: 531-536; Clason 1974: 78-89).

Eastern India

In Eastern India, the information about faunal remains comes from the sites of Vaisali, Jaugada, Mahisadal and Bharatpur. Main features of the faunal data from those sites are discussed as follows:

The Vaisali site, located in Muzzafarpur district in northern Bihar, revealed a cultural sequence divisible into four different periods. The first occupation at the site began in 500 BCE. Then, the site appears to have been deserted after the late Gupta period (around CE 600). The 'Period I' at the site revealed a complete skeleton of the hyaena that Prasad as of a female. Based on the disposition of skull bones, he suggested that the species was in a transitory phase of phylogeny and opined that the specimen probably represented a transitional form to account for the admixture of features common to civet and hyaena, prior to the final descent of the recent hyaena (Prasad 1961: 67-68). The site also revealed a large number of terracotta figurines of bull, elephant, ram, horse, dog and snake. According to Sahu, serpent figurines have a hoary antiquity in northern India and apparently, the Nag cult was in vogue in the lower Ganga plain, as such the figurines are also known from the contemporary layers at Pataliputra, Sonepur, Rajgir and Chandraketugarh (Sahu 1988: 242). The site of Vaisali also revealed a number of artefacts made of the animal bones, ivory and shell.

The state of Odisha is a poorly studied with respect to bio-archaeological datasets. Jaugada, an early historical site, is the only one where preliminary information about the faunal data exists. That site, located in Ganjam district, has been tentatively dated to 300 BCE and CE 300 (*IAR* 1956-57: 31). Nath studied the faunal remains unearthed from the site. His analysis revealed the presence of cattle, buffalo, sheep, goat, pig, dog, ass and *chital*. He also identified the presence of two turtles (*Chitra indica* and *Lissemys punctata*) in the assemblage (Nath 1963: 1-63). As the data he presented is preliminary in nature, no conclusive statements can be made about the animal husbandry at that place.

The information about the Iron Age fauna in West Bengal comes from the Mahisadal and Bharatpur sites. Banerjee studied the faunal remains recovered from the Iron Age level at the Mahisadal site, located in Birbhum district. He reported the presence of cattle, goat, dog, *chital* and sambar. The animals present in the preceding neolithic or chalcolithic phase at that site, such as pig, jungle cat and *barasingha*, were found missing in the Iron Age contexts. He Banerjee also studied the faunal remains recovered from the Bharatpur site, located in Burdwan district. The Iron Age faunal assemblage at that site revealed the presence of cattle, buffalo, sheep, pig, nilgai, camel, horse and fish (Banerjee 1979-80: 162-164).

Early Historical Shell Crafts

Considerable information is available for the Indus shell crafts, but that is not so for the early historical period. However, excavations at a number of early historical sites have revealed that shell working was an important activity during that period as well. That can especially be evidenced from the sites located in the coastal region and from other sites that might have remained the ports and trading centres. Additionally, the recovery of marine shells in the interior of subcontinent indicates the transfer not only of raw material and technology, but also of expertise.

As during the Indus period, Gujarat emerged as an important region for shell working during the early historical period. Some of the important shell working centres during the historical period in Gujarat were Dwarka, Bet Dwarka, Prabhas Patan, Shrijipura, Hathab, Amreli, Vadnagar and Nagra. The site of Vadnagar, probably one of the largest manufacturing centres in Gujarat during the early historical period, revealed a burnt sealing with a conch and a faint impression of writing beginning with a *swastika* with arms turned to the right (Irani 2005: 115). That clearly shows the importance of shell craft during the early historical period in Gujarat. Shell objects, commonly made in Gujarat during that period, included bangles, rings, inlays, pendants and beads. Compared to the Indus period, the shell bangles in that period were broad and carved intricately (Deshpande-Mukherjee 2008: 209-222). The bangles were decorated with the single wide-channel groove and multiple deep grooves, besides a wide variety of decorative geometric and floral motifs. *Turbinella pyrum* and *Pugilina buchephala* were the most commonly used shells for making bangles, beads and inlays.

The early historical period in the western Deccan also witnessed widespread use of shells and shell objects. Important early historical sites from where shells remains were reported are Maheshwar, Prakash, Kamrej, Bhokardan, Nasik, Nevasa, Paithan, Brahmapuri, Ter and Pune. The shell representation is not uniform in the Deccan region. It is more visible at the sites in western Deccan than in other parts. Deshpande-Mukherjee lately conducted study of some of those sites and revealed various aspects of shell procurement, manufacturing, trade and use. Her study showed that the species, like *Turbinella pyrum*, *Oliva* sp., *Cypraea* sp., *Monetaria moneta*, and *Conus* sp. and others were exploited for specific reasons (Deshpande-

Mukherjee 2008: 209-222).

Shell bangles made from *Turbinella pyrum* were the most commonly reported finds, as compared to other objects at those sites. The commonly observed designs on the bangle surface included series of slanting lines, incised lines, chevrons, diamonds, rope or twine lines, floral patterns and the circular or heart-shaped knobs in relief. Shell beads were another important object. Those were not only made from *Turbinella pyrum,* but also from other marine shells, such as *Oliva* sp., *Monetaria moneta* and *Cypraea arabica*. A number of miscellaneous objects were also made using the central columella of *Turbinella pyrum*. Those included simple cylindrical pieces, hollow octagonal objects bearing incised grooves as decorations at the ends, handles (all reported from Nevasa), pulley shaped ear ornament (reported from Nevasa, Maheshwar and Nasik), and hollow fish-like objects and stoppers (reported from Bhokardan). Other important findings are tortoise-shaped amulets reported from Kaundinyapur, Nevasa, Ter, Bhokardan and Satanikota. Such amulets have also been reported from sites in northern India like Taxila and Kosambi. In addition, rings, discs, buttons, inlays and a number of small carved-shell fragments have been reported from those sites. The presence of shell waste of *Turbinella pyrum*, comprising sawn portions from the apex, spire, main whorl, columella and base are also recorded at Maheshwar, Nevasa, Bhokardan, Kamrej, Ter and Pune (Deshpande-Mukherjee 2008: 213-214; 2006-07: 259-283).

Shells and finished shell objects were probably brought to the early historical sites of the Deccan from coastal Gujarat and the Konkan coast. It is also suggested that the Tamil Nadu coast may have been another resource area for the procurement of the shells. As many of the early historical sites like Prakash, Paithan and Ter were located on the important trade routes connecting the western and southeastern coasts. In addition to the procurement of shells and finished items from distant sources, the localised production of shell objects within the Deccan was made possible (Deshpande-Mukherjee 2008: 214). ‘During the early historical period, a growing demand for shell objects might have initiated shell working within the Deccan region. For this, regular procurement of complete *T. pyrum* shells from either the Gujarat or the southeastern coast could have resulted in the establishment of shell working centres. Evidence for this aspect is strongly evident from the presence of appreciable quantities of *T. pyrum* shell debitage at some of the sites like Nevasa and Bhokardan’ (Deshpande-Mukherjee 2008: 217).

Similarity in the type of objects and shell waste throughout the entire

Deccan indicates the use of a standardised shell working technology. While the use of bronze or copper saw for cutting shells was postulated for the Indus period, iron saws were probably employed in shell cutting during the early historical period. Both wide and narrow bangles were produced according to demand. Presence of intricately carved designs on bangles not only suggests the high degree of artisanship involved, but also indicates that the shell working might have constituted an important craft activity during that period. Inscriptions give evidence for the patronage given to various arts and crafts in that period that could have helped the shell industry to grow vigorously (Deshpande-Mukherjee 2008: 218-219).

Shells, finished shell artefacts and shell waste are known from the early historical sites of northern India. However, no major work has been done so far to understand shell crafts during the early historical period in most parts of India, though there are some modest attempts to comprehend the role of shells during those periods. For example, the study of shell remains from three historical period sites in coastal Orissa revealed that collection of shells was mainly for the dietary purposes. A few selected molluscan species were collected amongst which most common were *Meretrix casta*, *Anadara granosa* and *Telescopium telescopium*. Shellfish gathering was most probably done in inter-tidal areas along the shore and in sandy mudflats in the nearby estuary (Deshpande-Mukherjee and Mishra's 2002: 81-89).

Shell fishing and gathering activities seem to have acquired the status of an insignificant occupation during the late historical periods. The rigid caste system, social stratification and religious attitudes of the people might have isolated some of the communities involved in lesser important activities, like shellfish gathering. A look into the modern shellfish gathering also shows that the people belonging to the economically backward classes, with women and children being the major contributors, mostly carry out this activity. Gradually, shell bangle manufacture seems to have declined in most parts of India, but continued in West Bengal (Deshpande-Mukherjee and Mishra 2002: 87).

The Sacred Shankh

The *shankh* (*chank*, conch, *Turbinella pyrum*) came to occupy a special position in the ancient Buddhist and Hindu religions. The *Mahavamsha* and *Dipavamsha*, the Buddhists texts, mention *shankh* as the object that brings about favourable circumstances and good luck. When and how the *shankh* attained the status of a religious object in India are questions that cannot be answered based on the

tradition? Indus sites have revealed the evidence of ritual libation vessels made from the conch shell. Even today, that type of libation vessel is used throughout the subcontinent for that purpose and for making certain medicines. During the early historical period, particularly in northern India, the finds of complete conch shells are quite common. In addition, there is evidence of the terracotta replicas of conch shell from the early historical sites in northern India, such as Sanghol, Piprahwa and Ganawaria (*IAR* 1976-77: 51; 1985-86: 69). One can even play on those terracotta replicas, which sound like the natural *shankh*. The conch shells appear to have been in use as a trumpet in various religious events and rituals in southern India at that juncture, as mentioned in the Sangam literature (Deshpande-Mukherjee 2006-2007: 269). 'Buddhism to a certain extent had helped in promoting the use of shell objects as seen at the early historical sites from northern India' (Deshpande-Mukherjee 2008: 219). Gradually, *shankh* achieved popularity, which probably led to its numerous representations in the religious art and iconography. Thus, most of the incarnations of Vishnu are depicted holding a sinistral *shankh*, that is, a conch shell with the apex upward has its opening on the left. In rare instances, Shiv is also depicted holding a similar *shankh*. Those depictions indicate that *shankh* was as precious and sacred as to be the attribute of God. Trumpets made of the shells are used even today for a variety of religious purposes, and even daily worship at home starts with the blowing of a conch trumpet.

Emerging Picture

A number of excavated sites and the bones remnants from the Iron Age and early historical sites are not only quite impressive, but also voluminous. However, the information related to animal-based subsistence in most of the cases is quite preliminary, not allowing a closer look into the human-animal interactions during that period. Like the preceding cultural periods, cattle dominated the faunal assemblage in all the sites. The charring and cut marks on the bones of cattle indicate that beef was a preferred item of diet from the PGW period down to the early historical period. A large number of sites also throw light on the presence of young cattle that indirectly indicate the presence of dairying activities at those sites. Nevertheless, as the ratio of male and female animals has not been worked out in most of the cases, it may be difficult to say with certainty whether dairying activities took place at those sites. Additionally, while direct evidence is lacking, bulls and bullocks appear to have been employed for draft purposes. Traction power for agricultural production might have been a vital contribution of cattle. 'To the India peasant cattle was and is more of a capital asset which, once acquired, continues to pay necessary material dividends to the end of its life at a very low maintenance coast' (Sahu 1988: 264). Other domestic animals, as buffalo, sheep and goats also appear to have been reared for both diary and meat purposes. Buffaloes might also have been used for traction purposes. Possibly, pigs and fowls were kept mainly for meat. The bones of dog also occur quite commonly in the Iron Age and early historical sites; the dog may have served as a watch animal. Hunting of wild animals was quite common, and those significantly contributed to the diet of people. Additionally, the wild animals provided a variety of other useful products, such as hide, horn, antler, hoof and tusk.

The remains of horse and ass become abundant from the Iron Age and early historical sites. In addition, terracotta figurines of those animals also occur frequentently in the archaeological sites, especially in the Ganga Valley. The association of horse with the megalithic people in Vidarbha is noteworthy. While, its speed made it useful for quick and easy transport, the ass might have served as a useful pack animal. The elephant also attained an important status during that period, but its skeletal remains are not common in the archaeological sites. However, the terracotta figurines of elephant have been reported from a number of sites. A number of those figurines, exhibiting decorative motifs on the body, may suggest the significance of that

animal in the society. The discovery of an iron goad for the elephants from the upper layers of ‘Period I’ at Sravasti is a significant find in this regard. Such specimens have also been reported from the early Mauryan levels at Taxila. The elephant might have been used as a beast of burden. The evidence of the use of ivory is also attested to at a large number of sites.

Animal bones were used extensively for the manufacture of various kinds of tools, ornaments and other artefacts. Some of the frequently found artefacts include bone points, arrowheads, styli, pointers, bobbins, shovels, awls, gouges, hairpins, dices, handles and combs. The pattern of bone artefacts recovered from different sites is not uniform. The use of bone tools, even when iron was known, was probably because of its cost-effectiveness (Sahu 1988: 261). While the tools, such as shovels, pointers and scoops might have been used for detaching roasted flesh from the bones, some of the bone pointers might have been used as potter’s tool for making groves over the clay vessels and terracotta discs (Alur 1979b: 132; Sahu 1988: 261).

8.

Conclusions

OUR KNOWLEDGE OF THE DOMESTICATION OF VARIOUS ANIMALS HAS certainly been deepened significantly in recent years by the technological advancement in the field of molecular genetics. In particular, mtDNA data have allowed the elucidation of relationships of domestic animals with their wild species. Genetic studies combined with archaeological data have shown that Asia and Europe were the most important areas for domestication of the main livestock species and chickens. There are evidences of 'multiple domestication' for most of the species. Those domestication events often involved more than one ancestor species or subspecies. While the specific location and timing of the domestication varies, the domestication of all four major species (sheep, goat, pig and cattle) appears to have involved a process in which extensive utilization of wild progenitor species evolved into the management of domestic animals.

However, all those aspects have already been discussed in a reasonably detailed manner in the main body of this work. From that, it becomes amply clear that throughout the course of history, humans have increasingly found the effective ways of using animals to meet their needs and requirements. Human relationship with the animals has advanced from inquisitiveness to friendship, to kinship and then to deification. That relationship kept on with the development of new ways, in which animals may be manipulated and used to fulfil human needs and desires.

However, the rapid intensification of livestock production in recent years has provided the most convincing testimony of such increasing exploitation of animal resources. With the tremendous progress in the field of molecular biology, humans are now able to reach out into the DNA of animals. This has resulted into the gene mapping of the farm animals, which in turn, has become an important tool for locating, isolating and characterising the genes that are responsible for specific traits, important to both health and production. Humans are now turning to animals in trying to develop a wonder drug to cure terminal diseases such as cancer or AIDS. One of the most controversial applications of DNA technology has been the creation of transgenic

animals (containing artificial inserted gene from another species). Cloning of animals today has become a reality. Cloning could be feasibly used to create animals that grow faster for food production and are more resistant to diseases. More importantly, cloning can also play an important role in protecting the biodiversity of species by keeping appropriate cells and embryos in cold storage. However, it remains to be seen whether animal cloning or transgenic animals will gain widespread acceptance. All said, the important thing to note is that this signifies a crucial development in the age-old practice of animal husbandry.

While, so much is happening in the field of genetic engineering, many of the animals are on the verge of being lost forever due to industrialisation and poaching. Some species are already extinct. The cheetah, which was frequently caught and used for hunting game animals during the Mughal times, was last reported in India several years ago. Lion, the national emblem of India, is now confined only to the Gir forest of Saurashtra in Gujarat. These are the last lions of Asia. Other animals, which are fast vanishing, include the musk deer, the wild buffalo, the bison and the wild ass. Tigers are also declining in numbers, and it is likely that, unless preserved, these will also vanish sooner than later. Some of the famous birds also are disappearing. The great Indian bustard is becoming rare. The pink-headed duck, once common in northeastern India, has not been seen for the past several years anywhere in the country.

The loss of diversity within the wild fauna is already evident, and it is becoming equally so within the domesticated species. After domestication, animals become adapted to different climates and environments, leading to a large number of breeds and sub-breeds (all over the world) within each species, which tend to differ from each other markedly. However, the modern commercial breeding methods are focusing on some favoured breeds, resulting into lack of diversity within domestic animals. In addition, the methods of animal husbandry are also changing very quickly. Tractors are gradually replacing animals in farming activities. The power-producing animals are now on the decline. This is especially true in the case of horse. The birth of modern engines gave tough competition to these animals, and is now bringing about a reduction in the numbers of this species. The horse has essentially no other use, but its power and it develops too slowly to be a successful meat producer. Its milk is also consumed at a very few places. Although, the horse is still used as a saddle animal in some parts of the world, who knows how long will that last? However, use of horses for pleasure activities, such as horseracing, will continue as long as humans can afford to keep them (Bökönyi 1984: 171-173).

So where does this leave us? Clutton-Brock in her celebrated work *Natural History of Domestic Mammals* says,

> In any attempt to trace the history of man's exploitation of the animal world we have to remember that we are dealing with the human being, a species once termed 'the irascible ape', who at the same time is not an ape because of his powers of conceptual thought and capacity to plan for the future. Man has changed the world and will continue to do so. There is no easy solution to the problems of over-population and the needs of the hungry, but if man is irascible he is, as well, endlessly ingenious and adaptable. He is also an artist who, since the Palaeolithic period, has shown his appreciation of the beauty and diversity of form to be found in living animals, and we must no longer continue with the extermination of these animals. Despite the commercial greed that holds an unrelenting grip on modern societies, we must believe that altruism will prevail, that some wild places will remain, and that we will learn how to manage and protect an increasing number of wild animals and plants that at present appear doomed.
>
> *Clutton-Brock 1987: 192-193.*

While, the humans have lost most of their wilderness, they have not yet lost their deep need to care for others, and it looks like they never will. Whatever the situation is at present, it seems likely that human-animal bond will continue to expand, and we seriously hope it will.

Glossary of Technical Terms and Acronyms

AMS Dating : The full form of AMS is Accelerator Mass Spectrometry. It is a way to obtain radiocarbon dates from samples that are far tinier than that needed for standard radiocarbon dating.

Ancient DNA (aDNA) : Any DNA fragment recovered from a fossil.

Arboreal : Inhabiting or frequenting trees.

Archaeozoology : Discipline that studies the faunal collections unearthed from archaeological sites in order to provide indications of which animals were living with or around the human archaeological population as well as to deduce environmental features of the site.

Archaic *Homo sapiens* : The name given to fossil humans that lived in Africa, Europe, and Asia from about 400,000 to 200,000 or 100,000 years ago with features intermediate between *Homo erectus* and modern *Homo sapiens*, and which may represent separate species.

Artifacts : Human-made objects; the preserved material remains and evidence of human or hominid cultural behaviour.

Assemblage : A group of objects found together in an archaeological setting.

Awl : A pointed tool used to punch holes in the skins, wood or other material, made out of stone or bone by prehistoric humans.

Biface : A flat stone tool produced by extracting flakes from both sides of a core until an edge is obtained along the whole perimeter. The most common form of bifacial tools is hand axe.

Bipedal : Walking upright on two legs.

Bovid : Member of the mammalian family Bovidae, the cloven-footed ungulates.

BP : Before the present: (in radiocarbon dating) in a specified amount of time or at a specified point in time before CE 1950.

Breed : Specific type of animals within the same species.

BRW : Black-and-Red Ware.

Carnivory : The condition of eating flesh.

Cenozoic : The era from 65 million years (Ma) to the present, also called the Age of Mammals. It is divided into the Tertiary and Quaternary periods.

Chopper : Large, roughly formed stone tool; generally used to describe and heavy tool that is not shaped like an axe, blade etc.

Chromosomes : A long continuous piece of DNA on which rest genes.

Cretaceous : The last geological period of the Mesozoic era, about 145–65 Ma.

DNA : Deoxyribonucleic acid; the molecule that carries genetic code and that is found in every living cell of an organism. Genes are located on strands of DNA.

Epiphyseal Fusion : Epiphyseal Fusio Growing bones consist of three main components: (1) the epiphysis (the separate articular ends), (2) the diaphysis (ends of the long bone), and (3) the metaphyses (zone of growing cartilage) which separates and joins the two. Epiphyseal fusion occurs around skeletal maturity, when the cartilage ossifies and joins the separate growing components.

Exostosis : A benign outgrowth from a bone (usually covered with cartilage).

Extinct : No longer existing; said of any species in which all members have disappeared.

Feral : Back in the wild after being domesticated.

Fossil : Any preserved remains or traces of past life, more than about 10,000 years old, embedded in rock as mineralised remains or impressions, casts or tracks.

Gene : A portion of a DNA strand that controls a particular inherited trait.

Genetic diversity : Genetic variation within a population or species that results from differences in their hereditary material. It is essential for populations to be able to adapt to changing conditions, and for individuals to maintain their fitness.

Genome : The complete genetic instructions embodied in the DNA of a species.

Genotype : Genetic constitution.

Genus (plural: genera) : A taxonomic name entity for one or more closely related organisms that is divided into species; names of organisms, such as *Bos indicus*, are composed of two parts, the genus name (first) and the species name (second).

Holocene : One of the Quaternary epochs of the Cenozoic Era, beginning about eight thousand years ago and continuing to the present.

Hominin (alternatively-Hominid) : Fossil and living human beings.

Hunter-gatherer : One who lives by hunting and scavenging wild animals, gathering plants and, in some places, collecting shellfish and fishing, often moving in small groups (bands) from place to place.

Interglacial : Term used to describe a period between glaciations when ice sheets retreat.

Kya : An acronym for thousand years ago, a unit of time sometimes used in astronomy, geology, paleontology, and biology

Microsatellite DNA(mtDNA) : Sequential tandem repeats in DNA; di-, tri-, tetra, or pentanucleotide repeats found in the centromere and scattered throughout some genomes.

Morphological : Pertaining to the body form and structure of an organism.

NBPW : Northern Black Polished Ware.

NISP : Number of Identified Specimens (NISP) represents the total number of identified animal skeletal fragments from one site.

OCP : Ochre Coloured Pottery.

Palaeontology : The study of fossils and the biology of extinct organisms.

Phalange : One of the set of 14 finger bones in each hand and foot. There are five proximal phalanges. These articulate proximally with the five metacarpals in the hand, and the five metatarsals in the foot. There are four middle phalanges in each hand and foot (absent in the

thumb and the toe). There are five distal phalanges in each hand and foot.

Phenotype : What an organism looks like because of the interactions of its genotype and the environment.

Pleistocene : One of the Quaternary epochs of the Cenozoic Era, lasting from about 1.8 million years ago (mya) to eight thousand years ago (kya).

PGW : Painted Grey Ware.

Species : In classification, the most basic biological unit of living organisms; members of a species can interbreed and produce fertile offspring.

Taxon (plural: taxa) In classification, a single kind of organism; the word *taxa* describes a group of related organisms.

Taxonomy : The rules and procedures used in the classification of organisms.

Ungulates : Hoofed mammals. Any number of mammals with hooves that are superficially similar, but not necessarily closely related taxonomically.

Zoogeography : The study of the geographic distribution of animal species.

Appendix 1

Scientific Names of Domestic Animals as used in this book

Appendix 2

Variability in horse and horse ornaments as noticed in different sites (After Vaidya and Goyal 2012)

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